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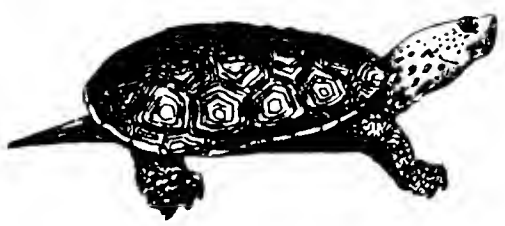

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

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NOTES ON THE TURAN BIOSPHERE RESERVE HERPETOFAUNA, NORTHEASTERN IRAN

Robert G. Tuck, Jr.*

ABSTRACT

One species of amphibian, the green toad (*Bufo viridis oblongus*), and 20 species of reptiles, Comprising the Afghan tortoise (*Agricnemys horsfieldi*), 4 agamid lizards (*Agama agilis, A. n. nupta* (?), *Phrynocephalus mystaceus galli, Ph. scutellatus*), 4 gekkonid lizards (*Agamura persica, Cyrtodactylus caspius, Teratoscincus bedriagai, T. scincus*), 4 lacertid lizards (*Eremias fasciata* (?), *E. persica, E. v. velox, Meislina guttulata watsonana*), 1 varanid lizard (*Varanus griseus caspius*), 1 boiid snake (*Eryx tataricus*), 4 colubrid snakes (*Coluber karelini, C. rhodorhachis ladacensis, Psammophis lineolatus, Spalerosophis diadema schiraziana*), and a single viperid snake (*Pseudocerastes p. persicus*), are documented from the Turan Biosphere Reserve. Collecting data, ecological information, measurements, and relevant observations are given for those forms within the Reserve, and a tentative zoogeographic analysis of the Turan herpetofauna is attempted.

Introduction

The Turan Biosphere Reserve, formerly the Turan Protected Area, which included a wildlife refuge, is administered by the Iran Department of the Environment and covers more than 1.8×10^6 hectares on the northeastern margin of the central Iranian desert (Spooner, 1977). Politically, the Reserve lies in Semnan Province, but it is very near the boundary of Khorasan. The approximate location and general area of the Turan Biosphere Reserve are shown on Map 1.

Firouz (1974) described the topography of the region as mountains, foothills, and plains, with desert, semi-desert, and steppe vegetation. He listed representative gamebirds (4 species) and medium to large mammals (14 species) for the region. Harrington (*in* Spooner, 1977) listed 65 species of mammals comprising 21 families in 7 orders within Turan. Unpublished data compiled by the Department of the Environment indicate that 164 species of birds may be encountered in the Turan Biosphere Reserve. Rechinger (1977) provided an annotated checklist of 375 plant species for the area. According to Spooner (1977), both "flora and mammalian fauna generally show great affinity to the Kara Kum in Soviet Tukmenistan to the north."

Formerly Natural History Museum Advisor, Zoologist, & Curator of Herpetology, Iran National Museum of Natural History.

Until recently, the amphibians and reptiles of the Turan Biosphere Reserve remained relatively unknown. Data gleaned from Anderson (1966; *in* Fisher, 1968; 1974), Eiselt and Schmidtler (1975), Latifi (1975), Latifi et al. (1966), Tuck (1971), and incidental specimens in the collections of the Iran National Museum of Natural History (Muze-ye Melli-ye Tarikh-e Tabi'i)(MMTT), formed the basis for a preliminary analysis of the Turan herpetofauna circulated by Tuck (unpublished, 1976). Lately, intensive investigations undertaken by the author, as well as collections and observations made by researchers associated with the Turan Programme (Spooner, 1977), have made it possible to compile the material presented in this paper.

Acknowledgements

The author wishes to thank Prof. Brian Spooner for his interest, patience, assistance, discussions, and advice. Valuable assistance was also rendered by Mr. Rasik Bhadresa, and the aid of Misses Mary Martin, Lili Ramiyar, and Roushan Sadrulhefazi, and of Dr. Robin Dennell, is greatefully acknowledged. Mr. Brian O'Regan kindly provided photographs of the Afghan tortoise and desert monitor from within the Turan Biosphere Reserve. Dr. Randell E. Brown submitted specimens and data. Mr. Yadollah Seirani assisted in various phases of specimen identification and measurement. Special thanks are due to Mr. Mohammed Hassan Teheri, shepherd from Yazdu village, and to Mr. Baba Reza, headman of Tejur village, for their enthusiastic assistance in securing specimens.

Species Accounts

Class : AMPHIBIA

Order : SALIENTIA

Family : Bufonidae

Genus : *Bufo* Laurenti 1768

Bufo viridis oblongus Nikolsky 1896.

Turan Biosphere Reserve Material: (9) MMTT 1852, Tejur village, ca. 1100 m, collected 17 July 1977 by R. G. Tuck, Jr. (original no. RGT 3205); MMTT 1988, Baghestan village, 1275 m, collected 16 July 1977 by R. G. Tuck, Jr., and R. Bhadresa (original no. RGT 3202); MMTT 1989 - 1992, Baghestan village, 1275 m, collected 17 July 1977 by R. G. Tuck, Jr. (original nos. RGT 3206 - 3209); MMTT 2083, Kariz village, collected 11 October 1977 by R. Bhadresa (original no. RB-1); MMTT 2084, Nahar village, collected 12 October 1977 by R. Bhadresa (original no. RB-2); MMTT 2085, Delbar village, collected 13 October 1977 by R. Bhadresa (original no. RB-3).

Measurements: Meristic data for these specimens are given in Table 1.

Remarks: The local name for the green toad is "vasagh."

MMTT 1852 was collected during the mid-afternoon in an overgrown irrigation channel in which it was concealed beneath vegetation; the air temperature above the vegetation level registered 35°C. MMTT 1988 was taken at night in the courtyard of the village school; it was parasitized

by 3 leeches, one each on the upper foreleg, groin, and thigh. MMTT 1989 - 1992 were collected at night from the edge of a small pond behind the village school. Both MMTT 2083 and 2085 were collected in the evening, while MMTT 2084 was taken about 1200 hrs.

Class : REPTILIA

Order : TESTUDINES

Family : Testudinidae

Genus : *Agrionemys* Khozatsky & Mlynarski 1966

Agrionemys horsfieldi (Gray 1844)

Turan Biosphere Reserve Material: (1) MMTT 1901, 3 km southeast of Delbar village, collected in late January 1977 by R. Bhadresa.

Measurements: This specimen is represented only by its shell, for which the following data are recorded --

carapace length 177 mm
carapace width 146 mm
plastron length 161 mm
plastron width 132 mm
shell height 97 mm

The cervical scute in this individual is very small, practically non-existant. There are 11 marginal scutes on either side; the two 12th scutes are fused into a single supra-caudal. The specimen has 5 vertebral scutes, and there are 4 pleural scutes on each side.

Remarks: Figure 1 depicts two live Afghan tortoises observed by B. O'Regan in the vicinity of Ahmadabad on 17 April 1977.

Order : SQUAMATA

Suborder: LACERTILIA

Family : Agamidae

Genus : *Agama* Daudin 1802

Agama agilis Oliver 1807

Turan Biosphere Reserve Material: (19) MMTT 1208, 16 km south of 'Abbasabad, 800 - 870 m, collected 11 June 1975 by S. C. Anderson (original no. A 639); MMTT 1226, 34 km south of 'Abbasabad on dirt road, 870 m, collected 11 June 1975 by S.C. Anderson (original no. A650); MMTT 1771-1772, Delbar village, collected 28 July 1976 by R. E. Brown; MMTT 1782, 7.5 km east of Delbar village, 1100 m, collected 5 August 1976 by R. E. Brown (original no. REB 100); MMTT 1849 - 1850, 1 km north of Baghestan village, collected 24 April 1977 by R. Bhadresa; MMTT 1902, Baghestan village, collected 1 May 1977 by M. Martin; MMTT 1996 - 1997, near Posht-e-Aseman village, 1260 m, collected 15 Jult 1977 by R. G. Tuck, Jr. (original nos. RGT 3184 - 3185); MMTT 2001, Baba Kuh abandoned village, 1160 m, collected 15 July 1977 by R.G. Tuck, Jr., and R. Bhadresa (original no. RGT 3195); MMTT 2002, Baba Kuh abandoned village, 1160 m, collected

16 July 1977 by R.G. Tuck, Jr. (original no. RGT 3196); MMTT 2015 - 2016, Delbar village, 1205 m, collected 18 July 1977 by R. Bhadresa (original nos. RGT 3219 - 3220); MMTT 2017 - 2019, Delbar village, 1205 m, collected 19 July 1977 by R. G. Tuck, Jr. (original nos. RGT 3233 - 3234); MMTT 2037, between Khanehkhodi village and Delbar village, 1185 m, collected 20 July 1977 by R. G. Tuck, Jr. (original no. RGT 3248); MMTT 2046, vicinity of Baghestan village, collected 27 July 1977 by M. Martin.

Measurements: Meristic data for these specimens are given in Table 2.

Remarks: MMTT 1996 - 1997 were collected between 0830 and 0930 hrs, by which time the air temperature had reached 32°C. MMTT 2001 was taken just after sunset. MMTT 2002 was collected at 0900 hrs; air temperature 29°C, lizard body temperature 35°C. Both MMTT 2001 and MMTT 2002 were active on a sand and gravel dry river plain running through a major dune field. MMTT 2037 was one of several examples of this species observed living on sand dunes near the village of Qala Bala, between Khanehkhodi and Delbar villages; at the time of capture, 1935 hrs, the temperature of both the air and the surface of the sand was 35°C, while the body temperature of the lizard registered 36°C. All 7 adult females from the Turan Biosphere Reserve contained either ovarian or oviducal eggs; counts, measurements, and dates of collection of these specimens are given in Table 3. Seven live individuals from Delbar village, collected 18 - 19 July 1977 by R. Bhadresa and R. G. Tuck, Jr. (original nos. RGT 3221 - 3224, RGT 3235 - 3237), were presented to W. P. Hall, IIIrd, University of Melbourne, for karyological analysis.

Agama cf. A. nupta nupta de Filippi 1843

Turan Biosphere Reserve Material: (0)

Remarks: An individual believed to belong to this species was first observed in the Turan Biosphere Reserve by the author at Tejur village on 17 July 1977. The lone male evaded all attempts at capture, retreating deep into crevices within the vertical rock surface it inhabited above a spring. This particular large-scaled rock agama was seen several times between 1300 hrs and 1700 hrs; during the interval the air temperature was recorded as 35°C. On 29 August 1977 Mr. Bhadresa returned to Tejur and photographed the same lizard (Figure 2).

On 19 July 1977 the author observed droppings apparently produced by examples of this species on a rocky cliff 10 km (by road) north of Delbar village at an altitude of 1275 m. No actual agamas were seen, however, even though the site was examined from 1840 hrs, 19 July, until 1015 hrs, 20 July. A series of air temperature readings were made at intervals and may indicate that the visit did not overlap the lizards' normal activity periods --

19 July
1850 hrs, 37°C, breezy
2015 hrs, 33°C, windy
2110 hrs, 30°C, "

20 July
0620 hrs, 25°C
0650 hrs, 25°C
0800 hrs, 25°C (shade), 30°C (sun)
0900 hrs, 30°C
0930 hrs, 32°C
1000 hrs, 33°C

Anderson (1966:87) questioned previous reports of *A. nupta* in "extreme northeastern Iran," and cautions (*in litt.*, 2 November 1977) that this Turan sighting may really represent *Agama caucasica* (Eichwald 1831). The individual pictured here, however, closely resembles specimens of *A. nupta* preserved in the collections of the Iran National Museum of Natural History (MMTT) with regard to pattern and visible scalation, but clearly seems to differ from all *A. caucasica* at hand in these respects. Nevertheless, the matter must remain moot until verifiable material has been obtained and deposited into an accessible collection.

Genus : *Phrynocephalus* Kaup 1825

Phrynocephalus mystaceus galli Krassowsky 1932

Turan Biosphere Reserve Material: (4) MMTT 1848, below Kariz road, collected 11 April 1977 by M. Martin; MMTT 1903 - 1904, Tochah village, collected 18 May 1977 by M. Martin; MMTT 2003, vicinity of Baba Kuh abandoned village, ca. 1160 m, collected 16 July 1977 by R. Bhadresa and R. Dennell (original no. RGT 3199).

Measurements: Meristic data for these specimens are given in Table 4.

Remarks: The local name for the fringe-mouth toad-head agama is "kalepas-rigi."

All of these specimens were collected on sand dunes. A fifth example, collected by the author on an extensive dune area near Tochah village, 18 July 1977 (original no. RGT 3210), was presented alive to W. P. Hall, IIIrd, for karyological analysis. This individual ran into a burrow when pursued. It was caught at 1315 hrs and had a recorded body temperature of 37°C. At the time of capture other environmental data were noted as follow --

temperature of burrow 37°C
temperature of sand surface 52°C
temperature of air above sand surface 33°C
temperature of sand at depth of 160 - 200 mm 33°C

Specimens of *Phrynocephalus mystaceus galli* from the Turan Biosphere Reserve appear to differ markedly in a number of features from a series collected in Khorasan Province, 35 km north of Gonabad on the road to Torbat-e-Heydarieh, 850 m, on 9 June 1975, by S. C. Anderson and R. B. McCullers (original nos. A 602 - 606). The clear and sharply defined throat patterns seen in these latter examples, now catalogued as MMTT 1193 - 1197, do not appear in the Turan material. Meristic data for this series are summarized in Table 5 and may be compared with those of the previous group.

Phrynocephalus scutellatus (Olivier 1807)

Turan Biosphere Reserve Material: (30) MMTT 1203 - 1207, 16 km south of 'Abbasabad, 800 - 870 m, collected 11 June 1975 by S.C. Anderson (original nos. A 643 - 647); MMTT 1214 - 1224, salt flat 5 km west of Kahak on road to Shahrud, 800 m, collected 10 June 1975 by S. C. Anderson and R. B. McCullers (original nos. A 623 - 633); MMTT 1773, Delbar village, 1300 m, collected 29 July 1976 by R. E. Brown (original no. REB 60); MMTT 1795, 80 km south of Delbar village, collected 24 February 1977 (preserved 14 March 1977) by A. DeVos; MMTT 1995, Chohok spring, 1025 m, collected 17 July 1977 by R. G. Tuck, Jr. (original no. RGT 3204); MMTT 2020 - 2023, Delbar village, 1205 m, collected 18 July 1977 by R. Bhadresa (original nos. RGT 3211 - 3214); MMTT 2028 - 2033, Delbar village 1205 m, collected 19 July 1977 by R. G. Tuck, Jr. (original nos. RGT 3239 - 3244); MMTT 2038, between Khanehkhodi village and Delbar village, 1185 m, collected 20 July 1977 by R.G. Tuck, Jr. (original no. RGT 3247).

Measurements: Meristic data for these specimens are given in Table 6.

Remarks: Twenty-three (77%) of these specimens are juveniles measuring between 18.5 and 31.1 mm ($\bar{x}$ = 24.7 mm, SD = 3.2 mm) and were collected between 10 June and 19 July. Reproductive data taken from the 3 adult females are as follows --

MMTT 1203 (11 June), 11 ovarian eggs, 5 on the left and 4 on the right, the largest measuring 0.3 mm;
MMTT 1795 (24 February), 15 oviducal eggs, 8 on the left and 7 on the right, the largest measuring 4.5 mm;
MMTT 2020 (18 July), 11 ovarian eggs, 6 on the left and 5 on the right, the largest measuring 0.3 mm.

MMTT 1995 was collected on a gravel substrate at 1030 hrs; the air temperature was 33°C, while the surface temperatures recorded in the open and in the shade of a tamerisk bush were 40°C and 34°C, respectively. MMTT 2038 was captured on sand dunes at about 1845 hrs; the temperature above the sand was recorded as 40°C, while temperatures of the sand surface and 150 mm beneath the surface registered 45°C and 38°C, respectively.

Seven living examples of *Phrynocephalus scutellatus* from Delbar village, collected 18 July 1977 by R. Bhadresa (original nos. RGT 3225-3231), were presented to W. P. Hall, IIIrd, for karyological analysis.

Family : Gekkonidae

Genus : *Agamura* Blanford 1874

Agamura persica (Dumeril 1856)

Turan Biosphere Reserve Material: (1) MMTT 2087, Harp village, 4 km east of the pass through the Kuh-e-Majred, collected 14 October 1977 by R. Bhadresa (original no. RB-5).

Measurements: The following counts and measurements (in mm) were taken from this specimen, which is a male --

snout/vent length 63.9
tail 58
number of scales around body 117
number of upper labials 15 + completely divided rostral
number of lower labials 10
number of lamellae under fourth toe 21

Remarks: This individual was collected at 1145 hrs.

Genus : *Cyrtodactylus* Gray 1827

Cyrtodactylus caspius (Eichwald 1831)

Turan Biosphere Reserve Material: (6) MMTT 1775, Delbar village, 1300 m, collected 12 July 1976 by R. E. Brown (original no. REB 64); MMTT 1993, Baghestan village, 1275 m, collected 16 July 1977 by R.G. Tuck, Jr., and R. Bhadresa (original no. RGT 3203); MMTT 2004 -2005, Baba Kuh abandoned village, 1160 m, collected 16 July 1977 by R.G. Tuck, Jr. (original nos. RGT 3197 - 3198); MMTT 2024, Delbar village, 1205 m, collected 19 July 1977 by R.G. Tuck, Jr., (original no. RGT 3245); MMTT 2086, Delbar village, collected 13 October 1977 by R. Bhadresa (original no. RB-4).

Measurements: Meristic data for these specimens are given in Table 7.

Remarks: All of these individuals were collected from the vertical surfaces of walls. MMTT 1993 was taken at night from the mud-brick wall of a fortress. Both MMTT 2004 and 2005 were taken from the interior mud-brick walls of a vacant building within an abandoned village between 0915 and 0945 hrs; other individuals were seen, but not collected. The air temperature within the room was 28° - 29°C, while the body temperature of MMTT 2005 registered 29°C. MMTT 2024 was asleep on the exterior wall of a cement building when it was captured at 1600 hrs; the air temperature was recorded as 35°C, while the lizard body temperature registered 34°C. MMTT 2086 was taken from the wall of a building during the afternoon hours.

MMTT 2005 contains 10 ovarian eggs, 6 on the left and 4 on the right, the largest measuring 1.2 mm in diameter. Preservation of the internal organs of MMTT 2086 is too poor to assess reproductive data.

Four of the 6 examples from Turan possess regenerated tails. Eight other specimens of *Cyrtodactylus caspius* in the collections of the Iran National Museum of Natural History (MMTT) comprise an adult female and 7 juveniles (MMTT 507 - 514) collected in Shahrud city, Semnan Province, on 23 April 1974 by M. Thireau and R. Khazai (original nos. RGT 2869 - 2873, RGT 2904 -2906). While one juvenile, MMTT 508, lost its tail during capture, it is possible to combine data taken from the remaining 7 specimens with those from the Turan Biosphere Reserve samples to produce the tail-loss and regeneration information given in Table 8. Only one example (17%) of the 6 juveniles, which measure between 24.2 and 34.8 mm snout/vent length ($\bar{x}$ = 30.4 mm, SD - 3.9 mm), had lost its tail prior to collection; while 5 (71%) of the 7 adults, which measure between 45.7 and 60.7 mm snout/vent length ($\bar{x}$ = 54.6 mm, SD = 6.0 mm), had lost and regenerated their tails previous to capture.

Genus : *Teratoscincus* Strauch 1863

Teratoscincus bedriagai Nikolsky 1899

Turan Biosphere Reserve Material: (2) MMTT 2039 - 2040, between Khaneh-khodi village and Delbar village, 1185 m, collected 20 July 1977 by R. G. Tuck, Jr. (original nos. RGT 3249 -3250).

Measurements: Meristic data for these specimens are given in Table 9.

Remarks: Both examples were captured at 2100 hrs. They were stationed on the surface of a sand dune; surface temperature was 34 C, while the air temperature registered 30 C. MMTT 2039 contains 9 ovarian eggs, 4 on the left, 5 on the right, the largest measuring 1.6 mm in diameter.

Teratoscincus scincus (Schlegel 1858)

Turan Biosphere Reserve Material: (9) MMTT 2006 - 2014, vicinity of Baba Kuh abandoned village, 1160 m, collected 15 July 1977 by R.G. Tuck, Jr., and R. Bhadresa (original nos. RGT 3186 - 3194).

Measurements: Meristic data for these specimens are given in Table 10.

Remarks: All of these plate-tailed geckos were collected after dark. They were resting either on the clay surface of an abandoned field, or, more frequently, on the sand surface of the extensive dune formation that encroached upon the dry bed and gravel flood-plain of the Hojjaj River. Smaller individuals seemed to predominate in the former situation, larger ones in the latter. All examples seen were collected, and there appears to be an appreciable size difference between the sexes in this sample: the 4 males range between 68.6 and 73.0 mm snout/vent length ($\bar{x}$ = 70.9 mm, SD = 1.9 mm), and the 5 females range between 75.4 and 96.3 mm snout/vent length ($\bar{x}$ = 89.4 mm, SD = 8.4 mm). All of the females contain ovarian eggs; counts and measurements are presented in Table 11.

On 16 July 1977 the collection sites on the dune field were revisited and the following temperature data were recorded --

Time	Air	Surface	Shallow Depth	160 - 200 mm Depth
0630 hrs	19°C	---	---	---
0700 hrs	---	20°C	22°C	35.5°C
0715 hrs	---	25°C	23°C	30°C
0740 hrs	24.5°C	25°C	25°C	33°C
1000 hrs	32°C	44°C	31°C	30°C

Lizard activity was not observed until 0900 hrs.

Family : Lacertidae

Genus : *Eremias* Fitzinger *in* Wiegmann 1834

Eremias cf. E. fasciata Blanford 1874

Turan Biosphere Reserve Material: (2) MMTT 1229 - 1230, 42 km south-east of 'Abbasabad (by road), 920 m, collected 11 June 1975 by S. C. Anderson and R. B. McCullers (original nos. A 656 - 657).

Measurements: Meristic data for these specimens are given in Table 12.

Remarks: MMTT 1230 contains 6 ovarian eggs, 3 on either side, the largest measuring 1.0 mm in diameter. Anderson (*in litt.*, 2 November 1977) notes that the identification of these two examples is by no means positive and they may represent an undescribed form. I. S. Darevsky (per. comm.) concurs.

Eremias persica Blanford 1874

Turan Biosphere Reserve Material: (12) MMTT 1201 - 1202, 16 km south of 'Abbasabad, 800 - 870 m, collected 11 June 1975 by S. C. Anderson (original nos. A 641 - 642); MMTT 1776, 2.5 km northeast of Delbar village, 1400 m, collected 13 July 1976 by R.E. Brown (original no. REB 67); MMTT 1778, 7.5 km east of Delbar village, 1200 m, collected 5 August 1976 by R.E. Brown (original no. REB 97); MMTT 1781, 7.5 km east of Delbar village, 1100 m, collected 5 August 1976 by R. E. Brown (original no. REB 99); MMTT 1791, 3.5 km east of Delbar village, collected 5 August 1976 by R.E. Brown (caught by, and removed from stomach of *Coluber karelini*, MMTT 1785: see below); MMTT 1905, Tochah, collected 30 May 1977 by M. Martin; MMTT 1998 - 2000, near Posht-e-Aseman village, 1260 m, collected 15 July 1977 by R.G. Tuck, Jr. (original nos. RGT 3181 - 3183); MMTT 2025 - 2026, Delbar village, 1205 m, collected 18 July 1977 by R. Bhadresa (original nos. RGT 3216 - 3217).

Measurements: Meristic data for these specimens are given in Table 13.

Remarks: The local name for the Persian steppe lacerta is "aroosmar."

The pursuit, capture, and swallowing of MMTT 1791 by a spotted desert racer, *Coluber karelini* (MMTT 1785), was witnessed by the collector. MMTT 1998 - 2000 were collected between 0830 and 0915 hrs; they regurgitated isopods after capture. The tails of MMTT 1778 and MMTT 1998 are 41% and 60% regenerated, respectively, while that of MMTT 2025 has healed and only begun regrowth. Reproductive data taken from specimens of Turan female *E. persica* are presented in Table 14.

Eremias velox velox (Pallas 1771)

Turan Biosphere Reserve Material: (2) MMTT 1228, 34 km south of 'Abbasabad, on dirt road, 870 m, collected 11 June 1975 by S.C. Anderson (original no. A 653); MMTT 1231, 42 km southeast of 'Abbasabad, by road, 920 m, collected 11 June 1975 by S. C. Anderson and R. B. McCullers (original no. A 569).

Measurements: Meristic data for these specimens are given in Table 15.

Remarks: MMTT 1228 was parasitized by a small tick in the axillary region.

Genus : *Mesalina* Gray 1845

Mesalina guttulata watsonana (Stoliczka 1872)

Turan Biosphere Reserve Material: (4) MMTT 1779, 11 km north of Delbar village, 1350 m, collected 2 August 1976 by R. E. Brown (original no.

REB 96); MMTT 1851, between the villages of Kariz, Shahbaz, and Baghestan, collected 19 March 1977 by M. Martin; MMTT 1994, vicinity of Ab-e-Raghn spring, 1530 m, collected 16 July 1977 by R. G. Tuck, Jr., and B. Spooner (original no. RGT 3200); MMTT 2027, Delbar village, 1205 m, collected 18 July 1977 by R. Bhadresa (original no. RGT 3218).

Measurements: Meristic data for these specimens are given in Table 16.

Remarks: The local name for the long-tailed desert lacerta is "malus."

MMTT 1851 was collected at 1200 hrs and contains 18 ovarian eggs, 10 on the left and 8 on the right, the largest measuring 1.2 mm in diameter. MMTT 1994 was collected at 1800 hrs; the air temperature was 30° C. MMTT 2027 was found to be heavily parasitized by invertebrate cysts, which filled the entire abdominal cavity.

The scant number of specimens listed here should not be taken as indicative of thesize and extent of the population of *M. guttulata watsonana* within the Turan Biosphere Reserve, for individuals are adept at evading capture, and many already captured quickly escaped before being securely bagged.

In using thegeneric designation *Mesalina* Gray 1845, Shcherbak (1974) has distinguished the long-tailed desert lacerta and its relatives from the other steppe lacertas (genus *Eremias* Fitzinger *in* Wiegmann 1834) inhabiting Iran, and it is his allocation that is followed here.

Family : Varanidae

Genus : *Varanus* Merrem 1820

Subgenus: *Psammosaurus* Fitzinger 1826

Varanus (*Psammosaurus*) *griseus caspius* (Eichwald 1841)

Turan Biosphere Reserve Material: (0)

Remarks: Although no Turan specimens have been deposited into the collections of the Iran National Museum of Natural History (MMTT), the transcaspian desert monitor is reliably reported as fairly common and widespread within the region (R. Bhadresa, pers. comm.; B. O'Regan, pers. comm.; B.Spooner, pers. comm.). Mr. O'Regan has kindly provided a transparency he made of an example of the transcaspian monitor on 18 April 1977, 10 km south of 'Abbasabad on the road to Dastjerd (Figure 3). Mr. Bhadresa recorded an encounter with a desert monitor in Zygophyllum habitat, 10 km southwest of Tejur, at 1230 hrs, on 28 April 1977.

Suborder: SERPENTES

Family : Boiidae

Genus : *Eryx* Daudin 1803

Eryx tataricus (Lichtenstein 1823)

Turan Biosphere Reserve Material: (2) MMTT 2047, Baghestan village threshing ground, collected 20 July 1977 by M. Martin; MMTT 2048, Baghestan village, collected 1 August 1977 by M. Martin.

Measurements: Meristic data for these specimens are given in Table 17.

Family : Colubridae

Genus : *Coluber* Linnaeus 1758

Coluber karelini Brandt 1838

Turan Biosphere Reserve Material: (2) MMTT 1785, 3.5 km east of Delbar village, 1200 m, collected 5 August 1976 by R. E. Brown (original no. REB 97); MMTT 1847, between the villages of Baghestan and Shahbaz, collected 19 March 1977 by M. Martin.

Measurements: Meristic data for these specimens are given in Table 18.

Remarks: The local name for the spotted desert racer is "sek-mar."

MMTT 1785 was observed to pursue, capture, and swallow a Persian steppe lacerta, *Eremias persica* (MMTT 1791: see above).

Coluber rhodorhachis ladacensis (J. Anderson 1871)

Turan Biosphere Reserve Material: (1) MMTT 1906, Baghestan village fortress, collected 25 May 1977 by M. Martin.

Measurements: Meristic data for this specimen are given in Table 19.

Although preserved, the head has been completely severed from the body, so that the snout/vent length figures given must be considered to be only approximate.

Genus : *Psammophis* Fitzinger 1826

Psammophis lineolatus (Brandt 1836)

Turan Biosphere Reserve Material: (2) MMTT 1783, north of Zamanabad, collected 16 August 1976 by R.E. Brown (original no. REB 108); MMTT 2034, Delbar village, 1205 m, collected 20 July 1977 by R. Bhadresa (original no. RGT 3246).

Measurements: Meristic data for these specimens are given in Table 20.

Genus : *Spalerosophis* Jan *in* de Filippi 1865

Spalerosophis diadema schiraziana (Jan *in* de Filippi 1865)

Turan Biosphere Reserve Material: (4) MMTT 1774, Delbar village, collected 29 June 1976 by R. E. Brown (original no. REB 62); MMTT 1908, on the Salehabad - Talkhab road near encroaching sand dunes, 1200 m, collected 11 July 1977 by M. Martin (original no. RGT 3179); MMTT 1987, Baghestan village fortress, collected 25 May 1977 by M. Martin; MMTT 2035, Delbar village, 1205 m, collected 21 July 1977 by R. G. Tuck, Jr. (original no. RGT 3251).

Measurements: Meristic data for these specimens are given in Table 21.

Remarks: MMTT 1980 was swallowing a rodent at the time it was struck by a vehicle; the prey, badly crushed, according to the collector, was not saved.

Family : Viperidae

Genus : *Pseudocerastes* Boulenger 1896

Pseudocerastes persicus persicus (Dumeril, Bibron, and Dumeril 1854)

Turan Biosphere Reserve Material: (3) MMTT 1780, 7.5 km east of Delbar village, collected 5 August 1976 by R. E. Brown (original no. REB 96); MMTT 2036, Delbar village, 1205 m, collected 18 July 1977 by R. Bhadresa (original no. RGT 3232); MMTT 2041, Annabu, 3 km northwest of Delbar village, collected 27 July 1977 by R. Bhadresa.

Measurements: Meristic data for these specimens are given in Table 22.

Remarks: In addition to these collected specimens, Mr. R. Bhadresa observed a live Persian horned viper 9 km south of Ahmadabad at 1530 hrs on 13 October 1977.

Conclusion

The 21 species of Amphibia and Reptilia listed in this paper undoubtedly do not represent the total herpetofaunal complement of the Turan Biosphere Reserve. Nevertheless, judging from the tortoise and lizard forms collected or observed within the area, it is possible to calculate the probable zoogeographic relationships represented by the sample at hand, based upon Anderson's (1968) designations and equating Spooner's (1977) Kara Kum element with "Aralo-Caspian." The following tabulation results from considering the 14 testudinate and lacertilian examples known to occur in the Turan Biosphere Reserve --

Aralo-Caspian Faunal Class	14.3% (2 species)
Iranian/Aralo-Caspian Faunal Class	7.1% (1 species)
Iranian Faunal Class	57.1% (8 species)
Iranian/Saharo-Sindian Faunal Class	21.4% (3 species)

While no study comparable to Anderson's work exists for the snakes, distributions of the 6 serpent species so far documented from the Reserve, as given by Bannikov et al. (1971), provide the following picture --

Aralo-Caspian Faunal Class	50% (3 species)
Iranian Faunal Class	50% (3 species)

It would seem that the ophidiofauna of the Reserve may show considerable affinity to that of the Kara Kum, Soviet Turkmenistan, in the sense of Spooner (1977).

By combining the faunal class assignments for all 21 species noted and including the green toad, *Bufo viridis oblongus*, as a member of the Iranian faunal class, the following tentative tabulation results --

Aralo-Caspian Faunal Class	23.8% (5 species)
Iranian/Aralo-Caspian Faunal Class	4.8% (1 species)
Iranian Faunal Class	57.1% (12 species)
Iranian/Saharo-Sindian Faunal Class	14.3% (3 species)

Pending further collecting and study, it may be concluded that the known Turan Biosphere Reserve herpetofauna, as in the cases of the floral and mammalian components, shows an appreciable relationship to that which may be regarded as characteristic of the Kara Kum to the north. It is too early, however, to apply precise terminology concerning the extent of the zoogeographic situation.

A thorough, wider ranging investigation of the amphibian and reptile fauna of the Reserve would provide the materials and data required to settle this question.

Note: Political boundaries and Iranian Governmental agencies cited in this paper refer to pre-revolutionary Iran and may no longer exist, nor conform to terminology employed by the current Islamic Republic of Iran.

Table 1. Measurements (in mm) for Specimens of *Bufo viridis oblongus* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Snout/Tympanum Distance	Snout/Eye Distance	Width of Rostrum	Width of Eye	Width of Tympanum	Length of Thigh	Length of Tibia	Length of First Digit	Length of Internal Metatarsal	Length of Paratoid
1852	♂	72.1	19.8	11.8	9.4	7.2	2.2	26.5	28.6	4.4	3.0	12.0
1988	♀	48.0	12.2	5.5	6.7	5.1	2.1	20.0	18.6	2.8	2.0	7.5
1989	♂	58.7	15.0	7.0	7.2	6.0	1.8	25.2	23.3	2.9	2.8	11.9
1990	♀	56.4	14.6	7.2	7.3	5.4	2.1	24.6	21.5	3.4	2.1	10.7
1991	♀	59.9	14.8	6.1	7.3	5.6	1.8	23.0	23.2	3.7	3.2	12.1
1992	♀	52.3	14.2	6.9	6.5	4.8	1.7	20.3	19.5	3.6	2.5	9.0
2083	♀	66.6	15.9	8.0	8.2	5.3	1.5	25.4	24.9	3.7	3.0	13.2
2084	♂	46.2	11.4	6.5	5.9	3.8	1.0	15.3	16.8	3.1	2.7	9.3
2085	♀	71.8	17.4	7.5	9.9	6.5	2.2	23.0	25.7	4.3	4.2	13.0

Table 2. Counts and Measurements (in mm) of Specimens of *Agama agilis* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows Around Body	Number of Upper Labials	Number of Lower Labials	Number of Rows of Callose Pre-anal Scales	Number of Lamellae Under Fourth Toe
1208	♀	82.5	132	73	19	15	1 (faint)	23
1226	♂	72.7	104	69	19	18	2	27
1771	♂	98.1	122	68	20	19	3	25
1772	♀	89.4	135	65	15	16	-	26
1782	juv.	30.0	54	-	19	17	-	28
1849	♀	78.3	119	63	18	16	-	26
1850	♂	67.0	109	72	17	17	2	25
1902	♀	70.6	114	68	17	18	-	26
1996	♀	90.2	126	68	17	18	-	23
1997	♀	88.3	116	68	16	16	1 (faint)	26
2001	♂	82.5	134	68	15	17	2	22
2002	♂	93.5	151	73	19	18	2	26
2015	juv.	40.7	71	66	14	16	-	26
2016	juv.	33.0	58	72	16	20	-	28
2017	♂	83.2	123	64	19	19	2	27
2018	♂	83.4	129	69	20	18	2	26
2019	juv.	42.0	73	72	18	17	-	26
2037	♀	69.3	95	74	18	18	1 (faint)	24
2046	♂	74.9	126	65	19	18	2	28

Table 3. Reproductive Data for Female Specimens of *Agama agilis* Collected in the Turan Biosphere Reserve.

MMTT Number	Date of Collection	Number of Oviducal Eggs (Left / Right)	Diameter of Largest Egg (mm)	Number of Ovarian Eggs (Left / Right)	Diameter of Largest Egg (mm)
1208	11 June	-- / --	--	9 / 10	1.5
1772	28 July	5 / 4	17.0	-- / --	--
1849	24 Apr.	4 / 4	9.1	-- / --	--
1902	1 May	4 / 3*	4.7	-- / --	--
1996	15 July	-- / --	--	11 / 8	1.1
1997	15 July	-- / --	--	10 / 8	1.5
2037	20 July	-- / --	--	7 / 0	0.8

*13 very small (1.1 mm) eggs, 8 left and 5 right, appeared to be undergoing resorption.

Table 4. Counts and Measurements (in mm) of Specimens of *Phrynocephalus mystaceus galli* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows Around Body	Number of Upper Labials to Edge of Mouth Fringe.	Number of Lower Labials to Edge of Mouth Fringe	Number of Lamellae Under Fourth Toe
1848	juv.	46.0	51	126	14	10	30
1903	juv.	55.5	71	123	18	10	31
1904	juv.	51.5	60	120	15	9	31
2003	♂	98.4	113	116	17	11	30

Table 5. Counts and Measurements (in mm) of Specimens of *Phrynocephalus mystaceus galli* Collected in Khorasan Province.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows Around Body	Number of Upper Labials to Edge of Mouth Fringe	Number of Lower Labials to Edge of Mouth Fringe	Number of Lamellae Under Fourth Toe
1193	♀	73.5	65	120	12	7	31
1194	♂	65.3	71	133	14	8	32
1195	♀	73.7	80	128	12	9	29
1196	♂	55.6	57	128	12	9	30
1197	♀	54.6	55	127	13	7	26

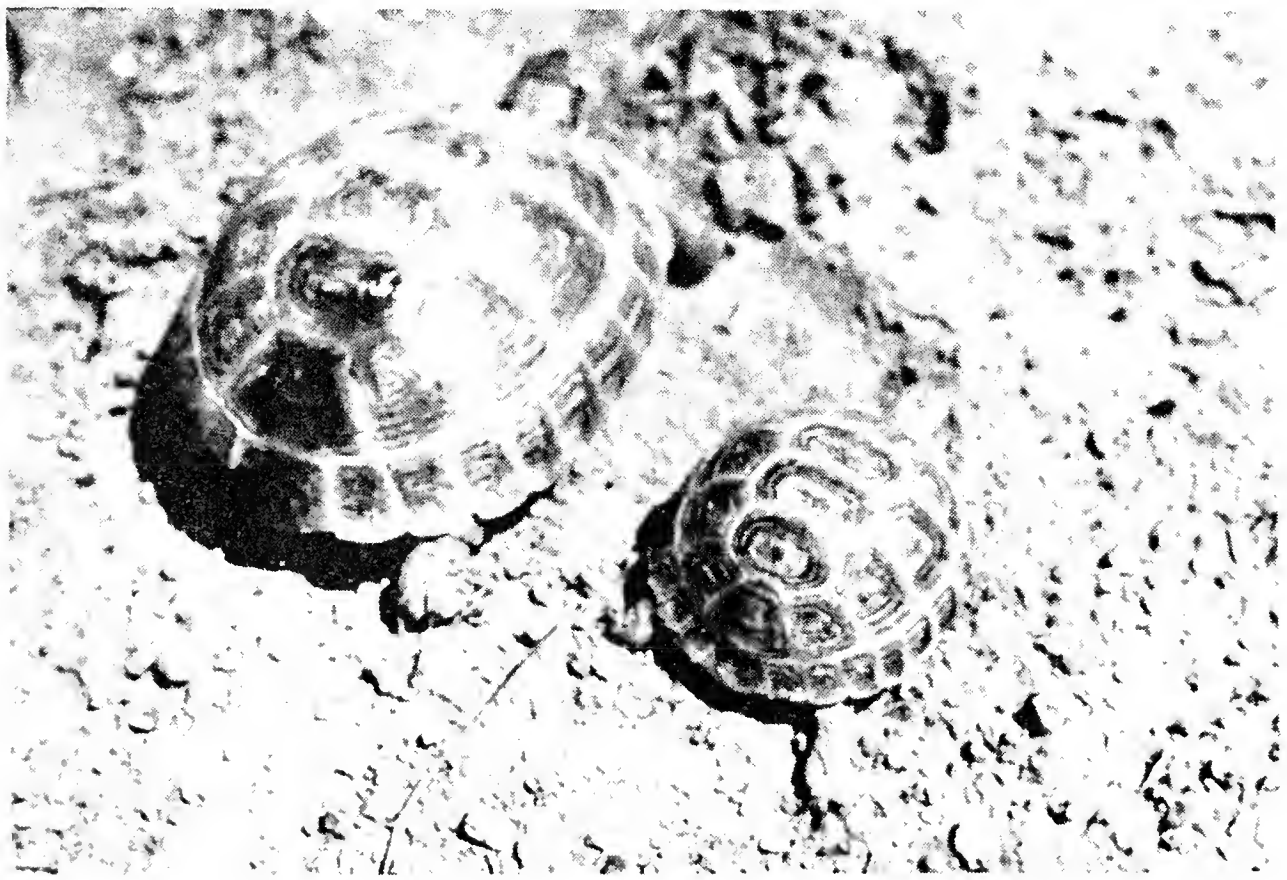


Figure 1. Two examples of the Afghan tortoise, *Agrionemys horsfieldi*, photographed near Ahmadabad on 17 April 1977. (Photo courtesy of B. O'Regan)

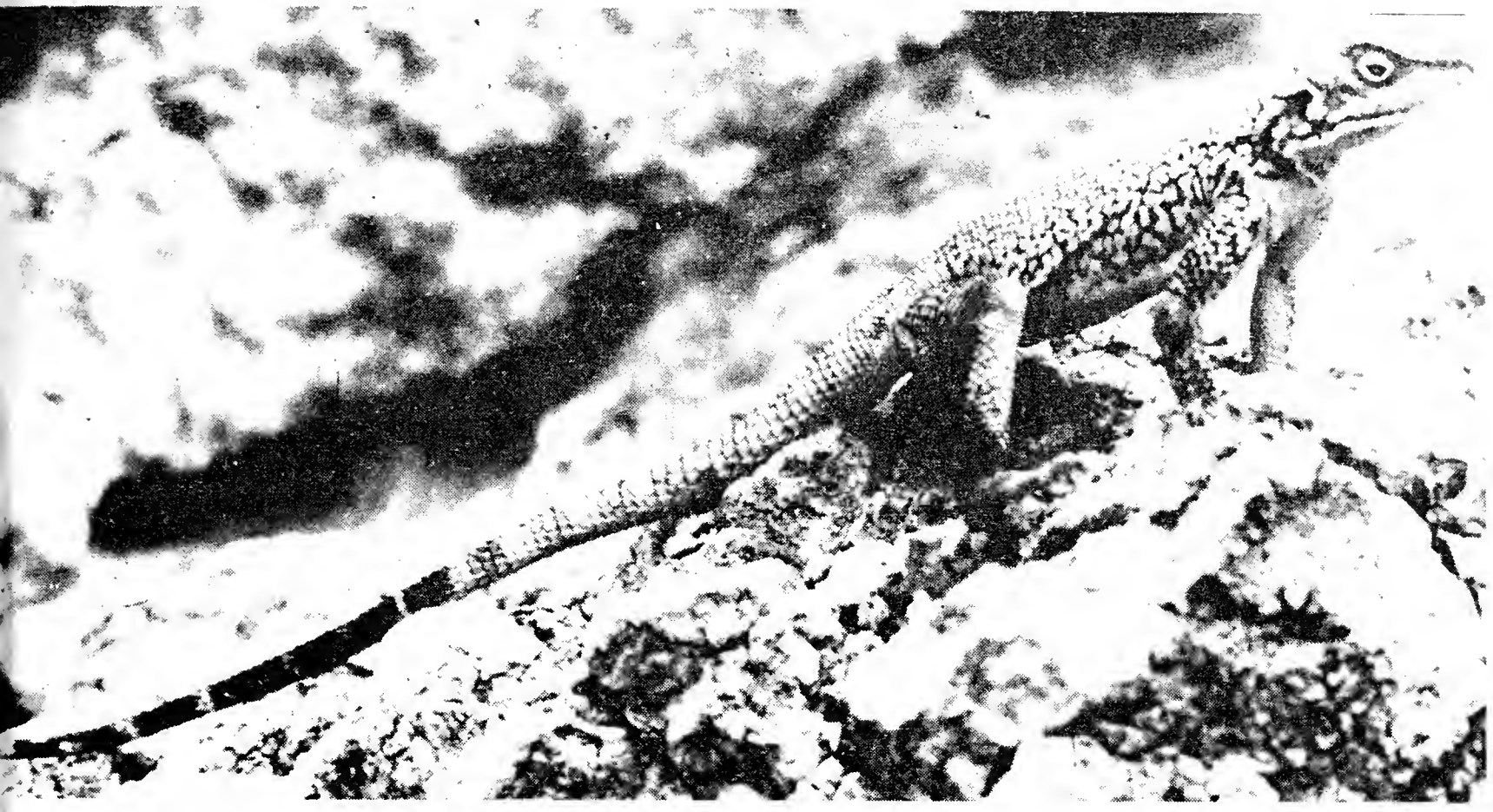


Figure 2. A male large-scaled rock agama, tentatively identified as *Agama nupta nupta*, photographed at Tejur village on 29 August 1977. (Photo courtesy of R. Bhadresa)

Figure 3. A transcaspian desert monitor, *Varanus griseus caspius*, photographed south of 'Abbasabad on 18 April 1977. (Photo courtesy of B. O'Regan).

Table 6. Counts and Measurements (in mm) of Specimens of *Phrynocephalus scutellatus* Collected in the Turan Biosphere Reserve

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scales Across Belly	Number of Upper Labials	Number of Lower Labials	Number of Lamellac Under Fourth Toe
1203	♀	44.3	55	42	13	12	25
1204	♂	41.1	52	39	13	13	24
1205	juv.	22.4	--	37	12	12	23
1206	juv.	22.1	29	37	15	12	25
1207	juv.	23.5	32	39	12	11	28
1214	♂	48.9	69	43	13	13	25
1215	juv.	24.1	34	44	12	13	27
1216	juv.	24.6	38	41	12	14	27
1217	juv.	21.6	37	38	14	11	25
1218	juv.	24.2	35	35	12	12	25
1219	juv.	26.6	40	37	15	15	24
1220	juv.	21.7	32.5	44	11	11	26
1221	juv.	20.7	31	39	11	11	23
1222	juv.	21.1	31	41	12	14	22
1223	juv.	24.7	39	43	14	11	26
1224	juv.	18.5	27	45	13	13	24
1773	♂	40.6	70	28	13	13	25
1795	♀	44.1	65	38	11	12	23
1995	juv.	26.4	39	43	14	13	27
2020	♀	45.2	64	42	13	12	24
2021	juv.	30.0	46.5	41	12	12	25
2022	juv.	25.0	39	45	12	11	27
2023	juv.	23.8	37	42	12	11	25
2028	juv.	31.1	45.5	40	12	13	24
2029	juv.	29.2	47	40	13	12	30

2030	juv.	26.2	38	35	14	11	26
2031	juv.	27.8	43	38	11	11	26
2032	juv.	28.7	44.5	44	13	13	26
2033	juv.	25.5	39	40	13	12	22
2038	♂	43.6	60	38	15	18	28

Table 7. Counts and Measurements (in mm) of Specimens of *Cyrtodactylus caspius* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scales Across Belly	Number of Upper Labials	Number of Lower Labials	Total Number of Femoral Pores		Number of Lamellae Under Fourth Toe
1775	♂	47.2	55*	29	10	9	25		25
1993	♂	60.7	65*	30	11	9	25		22
2004	♂	58.3	66*	29	12	8	27		24
2005	♀	45.7	52*	30	11	8	28	(faint)	22
2024	♂	54.0	74	28	10	8	29		23
2086	♀	59.2	79	34	12	8	0		23

*regenerated

Table 8. Tail-Loss and Regeneration in Specimens of *Cyrtodactylus caspius* Collected in Seman Province, Iran.

MMTT Number	Sex	% Original Tail	% Tail Regenerated
507	♀	13	87
509	juv.	100	-
510	juv.	100	-
511	juv.	-	- healed
512	juv.	100	-
513	juv.	100	-
514	juv.	100	-
1775	♂	73	27
1993	♂	18	82
2004	♂	65	35
2005	♀	52	48
2024	♂	100	-
2086	♀	100	-

Table 9. Counts and Measurements (in mm) of Specimens of *Teratoscincus bedriagai* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scales Around Body	Number of Upper Labials	Number of Lower Labials
2039	♀	56.1	28	47	10	9
2040	♂	55.5	29	47	9	10

Table 10. Counts and Measurements (in mm) of Specimens of *Teratoscincus scincus* Collected in the Turan Biosphere Reserve

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scales Around Body	Number of Upper Labials	Number of Lower Labials
2006	♀	95.2	55	31	10	10
2007	♀	96.3	70	32	10	9
2008	♀	91.4	57	32	10	10
2009	♀	88.5	56	34	9	9
2010	♀	75.4	52	31	9	9
2011	♂	70.0	47	32	11	10
2012	♂	68.6	36	31	10	9
2013	♂	73.0	53	32	10	10
2014	♂	71.8	50	--*	11	9

*skin torn

Table 11. Reproductive Data for Female Specimens of *Teratoscincus scincus* Collected in the Turan Biosphere Reserve*

MMTT Number	Number of Ovarian Eggs (Left / Right)	Diameter of Largest Egg (mm)
2006	5 / 0	2.2
2007	7 / 3	3.0
2008	4 / 4	1.6
2009	5 / 5	2.2
2010	5 / 3	2.5

*all collected night of 15 July 1977

Table 12. Counts and Measurements (in mm) of Specimens of *Eremias (cf. E. fasciata)* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Gular Scales	Number of Dorsal Scale Rows	Number of Upper Labials	Number of Lower Labials	Number pf Femoral Pores	Number of Lamellae Under Fourth Toe	Number of Ventrals, Lateral Series	Number of Ventrals, Transverse Series
1229	♂	60.6	113	28	53	10	7	16/17	28	18	32
1230	♀	43.1	74	29	49	9	8	15/16	28	18	34

Table 13. Counts and Measurements (in mm) of Specimens of *Eremias persica* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Gular Scales	Number of Dorsal Scale Rows	Number of Upper Labials	Number of Lower Labiels	Number of Femoral Pores	Number of Lamellae Under Fourth Toe	Number of Ventrals, Lateral Series	Number of Ventrals, Transverse Series
1201	♀	83.6	122	31	62	11	8	21/19	24	16	31
1202	♀	67.2	118	31	61	10	8	21/21	25	16	31
1776	♂	87.5	154	40	66	10	9	22/22	25	17	28
1778	♀	80.7	96*	34	66	11	9	20/20	25	15	30
1781	juv.	37.2	76	31	57	10	7	19/17	21	18	29
1791	♀	80.0	118	33	67	10	8	22/19	23	15	30
1905	♂	81.9	164	33	62	9	8	22/23	26	16	30
1998	♀	78.6	109*	36	63	11	9	17/18	27	16	31
1999	♀	74.9	115	33	58	10	11	18/17	24	16	30
2000	♀	71.9	97	36	61	13	8	20/20	25	16	33
2025	♀	78.0	23**	36	59	10	8	19/19	26	15	28
2026	juv.	39.8	72	30	40	10	8	21/20	25	--	--

*regenerated **healed

Table 14. Reproductive Data for Female Specimens of *Eremias persica* Collected in the Turan Biosphere Reserve.

MMTT Number	Date of Collection	Number of Oviducal Eggs (Left / Right)	Diameter of Largest Egg (mm)	Number of Ovarian Eggs (Left / Right)	Diameter of Largest Egg (mm)
1201	11 June	-- / --	--	12*/ 13*	3.9*
1202	11 June	-- / --	--	5 / 8	0.9
1778	5 Aug	-- / --	--	8 / 4	0.7
1791	5 Aug	-- / --	--	4 / 4	0.9
1998	15 July	-- / --	--	12 / 10	1.3
1999	15 July	2 / 2	13.7	5 / 9	1.6
2000	15 July	-- / --	--	** / **	**
2025	18 July	-- / --	--	** / **	**

*8 of these ovarian eggs, 4 on either side, were yellow-orange in colour, the largest measured as given; the remainder were white in colour, the largest measured 1.3 mm in diameter.
** both MMTT 2000 and 2025 contain numerous, indistinct, ovarian eggs on both sides.

Table 15. Counts and Measurements (in mm) of Specimens of *Eremias velox* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Gular Scales	Number of Dorsal Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Femoral Pores	Number of Lamellae Under Fourth Toe	Number of Ventrals, Lateral Series	Number of Ventrals, Transverse Series
1228	♂	59.9	112	29	59	10	9	20/19	21	16	31
1231	♂	63.5	81*	35	66	10	9	21/20	26	16	31

*broken

Table 16. Counts and Measurements (in mm) of Specimens of *Mesalina guttulata watsonana* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Gular Scales	Number of Dorsal Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Femoral Pores	Number of Lamellae Under Fourth Toe	Number of Ventrals, Lateral Series	Number of Ventrals, Transverse Series
1779	juv.	34.9	62	25	41	8	8	12/9+ (very faint)	21	10	28
1851	♀	47.0	81	26	41	9	8	11/12	22	11	30
1994	juv.	27.3	55.5	21	43	8	8	13/12	21	10	30
2027	♀	50.7	74	24	41	8	8	14/15	20	10	31

Table 17. Counts and Measurements (in mm) of Specimens of *Eryx tataricus* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Ventral Scutes	Condition of Anal Plate	Number of Subcaudal Scutes
2047	juv.	186	28	51	12	13	--*	single	30 pairs + 1
2048	o	345	46	49	11	15	185	single	29 pairs + 1

*specimen badly damaged

Table 18. Counts and Measurements (in mm) of Specimens of *Coluber karelini* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Ventral Scutes	Condition of Anal Plate	Number of Subcaudal Scutes	Number of Temporal Scales
1785	o	660	234	19	9	10	208	divided	103 pr. + 1	2+3+3/2+3+3
1874	♀	465	166	19	9	9	210	divided	102 pr. + 1	2+2+3/2+3+3

Table 19. Counts and Measurements (in mm) of the Specimen of *Coluber rhodorhachis ladacensis* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Ventral Scutes	Condition of Anal Plate	Number of Subcaudal Scutes	Number of Temporal Scales
1906	♀	745	219+*	19	9	9	214	divided	76 + prs.	2+3+3/2+2+3

*tip of tail missing

Table 20. Counts and Measurements (in mm) of Specimens of *Psammophis lineolatus* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Ventral Scutes	Condition of Anal Plate	Number of Subcaudal Scutes	Number of Temporal Scales
1783	juv.	196	62	17	9	10	180	divided	91 pairs + 1	1+2+2/1+2+2
2034	♀	548	142	17	9	12	181	divided	65 pairs + 1	2+2+3/2+2+3

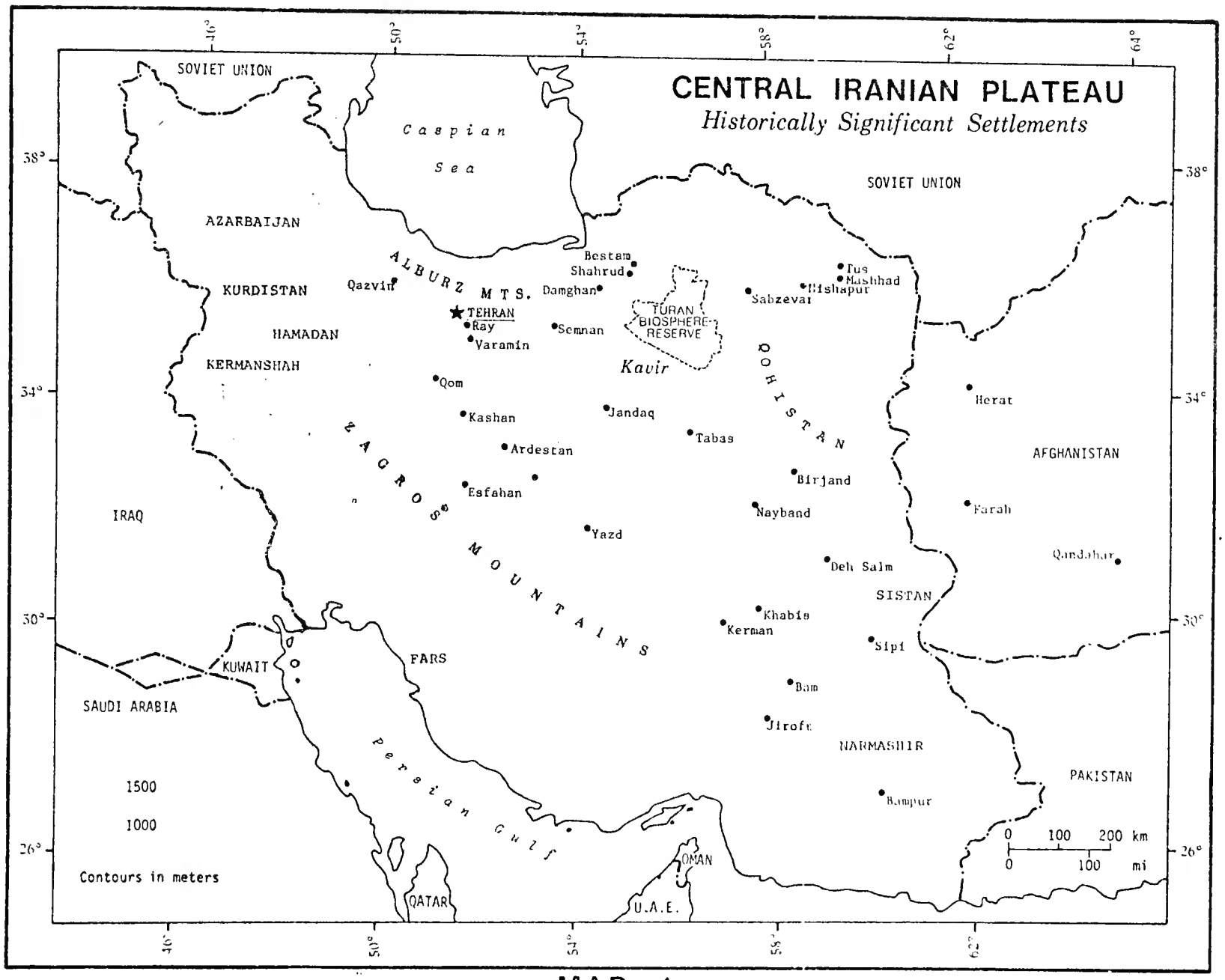
Table 21. Counts and Measurements (in mm) of Specimens of *Spalerosophis diadema schiraziana* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Ventral Scutes	Condition of Anal Plate	Number of Subcaudal Scutes	Number of Temporal Scales
1774	o	958	203	27	14	15	241	single	78 pairs + 1	4+5/5+6
1908	o	958	202	27	12	14	240	single	77 pairs + 1	3+3+4/5+5+4
1987	o	823	130+*	29	--**	--**	249	single	51+ pairs	---/---**
2035	o	920	166	27	12	12	233	single	61 pairs + 1	4+4+5/5+4+4

*tail broken, distal portion missing
**head badly crushed

Table 22. Counts and Measurements (in mm) of Specimens of *Pseudocerates persicus persicus* Collected in the Turan Biosphere Reserve.

MMTT Number	Sex	Snout/Vent Length	Tail Length	Number of Scale Rows	Number of Upper Labials	Number of Lower Labials	Number of Ventral Scutes	Condition of Anal Plate	Number of Subcaudal Scutes
1780	♀	596	73	23	12	15	156	single	35 pairs + 1
2036	juv.	316	48	23	12	16	154	single	44 pairs + 1
2041	♀	730	81	23	13	15	153	single	36 pairs + 1



MAP 1

Map 1. The Central Iranian Plateau, showing historically significant settlements and the Turan Biosphere Reserve. (Map courtesy of Dr. Hasan Mohammadi, Deputy Director, Department of the Environment, Imperial Government of Iran, Tehran).

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OCCURRENCE OF THE WEST INDIAN FROG, *ELEUTHERODACTYLUS JOHNSTONEI*, IN SOUTH AMERICA AND ON THE ISLAND OF CURACAO[1]

Jerry D. Hardy, Jr. and Herbert S. Harris, Jr.

For a number of years *Eleutherodactylus johnstonei* Barbour was generally regarded as a synonym of *Eleutherodactylus martinicensis* (Tschudi) (Parker, 1933; Grant, 1959). Schwartz (1967) presented unequivocal evidence, however, to show that *johnstonei* and *martinicensis* are, in fact, very distinct species. *Eleutherodactylus johnstonei* presumedly originated somewhere in the eastern Caribbean. It has had a long history of inter-island introductions (usually documented under the name *martinicensis*) and is now known to occur on at least fifteen eastern Caribbean islands as well as in Jamaica and Bermuda (Schwartz and Thomas, 1975; Maclean, Kellner, and Dennis, 1977; Hardy, Drewry, and Cole, MS).

The ease with which *johnstonei* is transported is emphasized by Barbour's statement (1930) that it occasionally appears "in hot houses in Europe and North America". The "*Hylodes martinicensis*" which Gunther (1895) reported as surviving in the Kew Gardens (London) from about 1885 to at least 1898 were, in fact, probably *Eleutherdactylus johnstonei*.

In 1970 and 1971 populations of *Eleutherodactylus* were observed and sampled in Georgetown, Guyana, and in Caracas and Cumaná, Venezuela. These frogs were tentatively identified in the field as either *Eleutherodactylus johnstonei* or *Eleutherodactylus martinicensis*. Since it is sometimes difficult to distinguish these two species morphologically, identification was ultimately based on laboratory comparisons of vocal patterns and electropherograms of leg muscle proteins. On the basis of these comparisons we have concluded that these frogs are *Eleutherodactylus johnstoni*.

More recently (1975) Charles W. Myers observed similar frogs near Willemsted, Curaçao, in the Netherlands Antilles. On the basis of vocal patterns, these frogs are also identified as *Eleutherodactylus johnstonei*.

Eleutherodactylus johnstonei produces a two-note whistled call (Fig. 1a). Published accounts of this call indicate that the first note varies from 1950 to 2150 Hz in frequency and from 0.07 to 0.09 seconds in duration, while the frequency of the second note varies from 3300 to 3700 Hz, and its duration from 0.18 to 0.27 seconds (Watkins, Baylor, and Bower, 1970; Lemon, 1971). Both notes are monotonal. *E. johnstonei* also produces a characteristic occasional call which typically consist of a rising "whee" note followed by one or more "ticks".

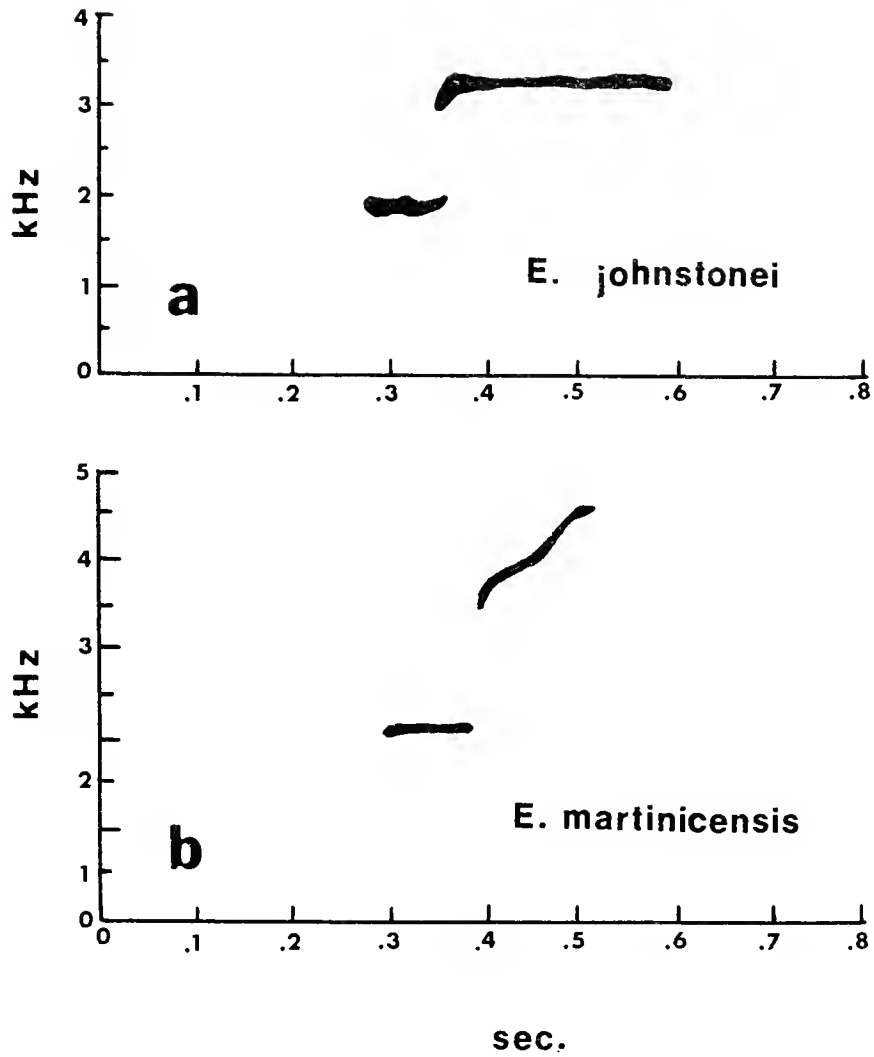

Figure 1. Sonogram tracings of the principal call of a) *Eleutherodactylus johnstonei* and b) *Eleutherodactylus martinicensis*.

Eleutherodactylus martinicensis produces a two-note whistled call (Fig. 1b) the first note of which is remarkably similar in frequency, duration, and structure to that of *E. johnstonei*. The second note, however, rises sharply (in contrast to the monotonal second note of *johnstonei*) and may terminate, as in the example illustrated, at frequencies as high as ca. 4600 Hz (well above the maximum recorded frequency of *E. johnstonei*). The occasional call of *E. martinicensis*, of which adaquate recordings are not available, consist of a prolonged series of series of "ticks", and is similar to the occasional call of *Eleutherodactylus coqui*, *E. portoricensis*, and *E. antillensis* as described by Drewry (1970).

Sonograms taken from recordings made in Georgetown, Guyana; Caracas and Cumaná, Venezuela; and near Willemstad, Curaçao (Fig. 2), clearly demonstrate that these frogs are *Eleutherodactylus johnstonei*, not *Eleutherodactylus martinicensis*. This conclusion is strengthened by recordings of occasional calls made in Cumaná, Venezuela, which structurally match occasional calls of known *johnstonei* recorded on St. Vincent (Fig. 3).

In electropherograms of leg muscle proteins of *Eleutherodactylus martinicensis* there are four major protein bands, the mid-points of which are located at points equivalent to 43,65,71, and 78 percent of the gel length; while in *Eleutherodactylus johnstonei* there are only three major bands, the mid-points of which are located at points equivalent to 25, 58, and 76 percent of the gel length (Fig. 4). Electropherograms of leg

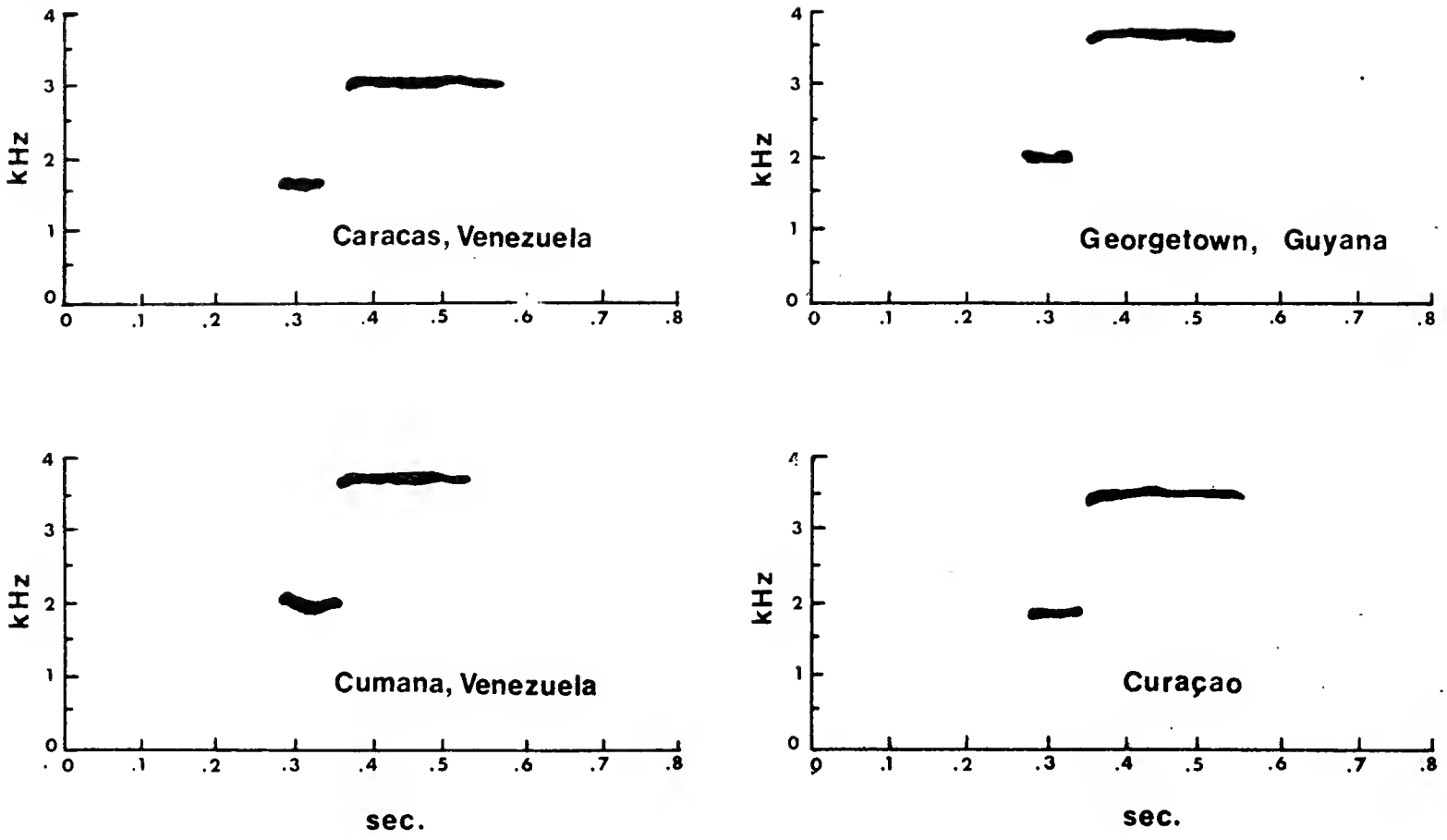

Figure 2. Sonogram tracings of the principal call of *Eleutherodactylus johnstonei* from South America and Curaçao.

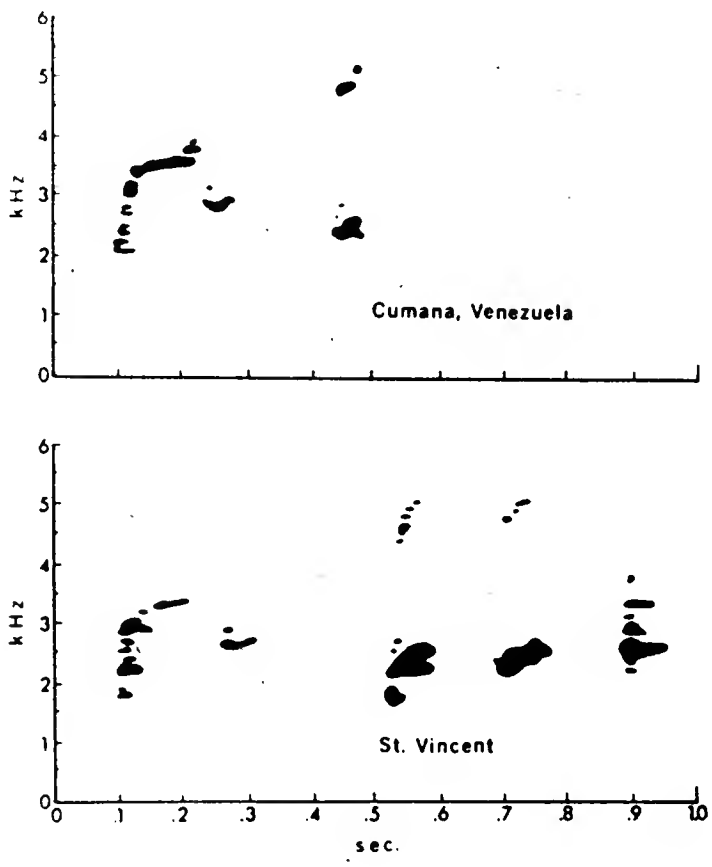

Figure 3. Sonogram tracings of theoccasional call of *Eleutherodactylus johnstonei* from South American and West Indian populations. The number of "tick" notes canvary from one to three or more in a given individual.

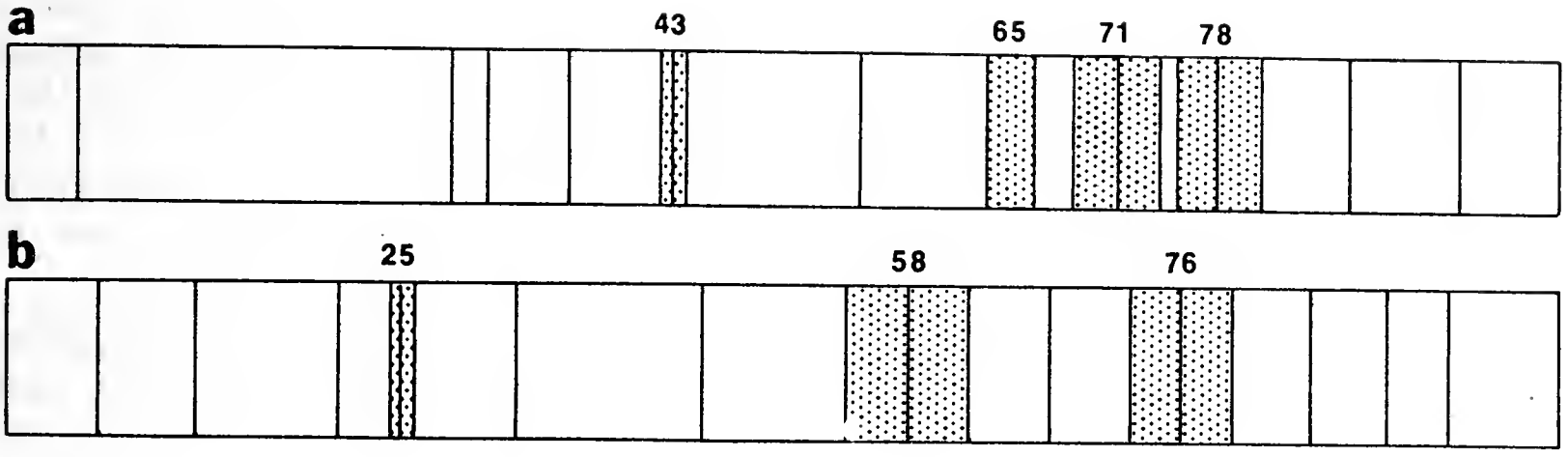

Figure 4. Electropherograms of leg muscle proteins as separated on 7% acrylamide gels. a) *Eleutherodactylus martinicensis*, Pointe-au-Pitre, Guadeloupe (n = 10). b) *Eleutherodactylus johnstonei* St. Vincent (n = 11). Figures are percent migration.

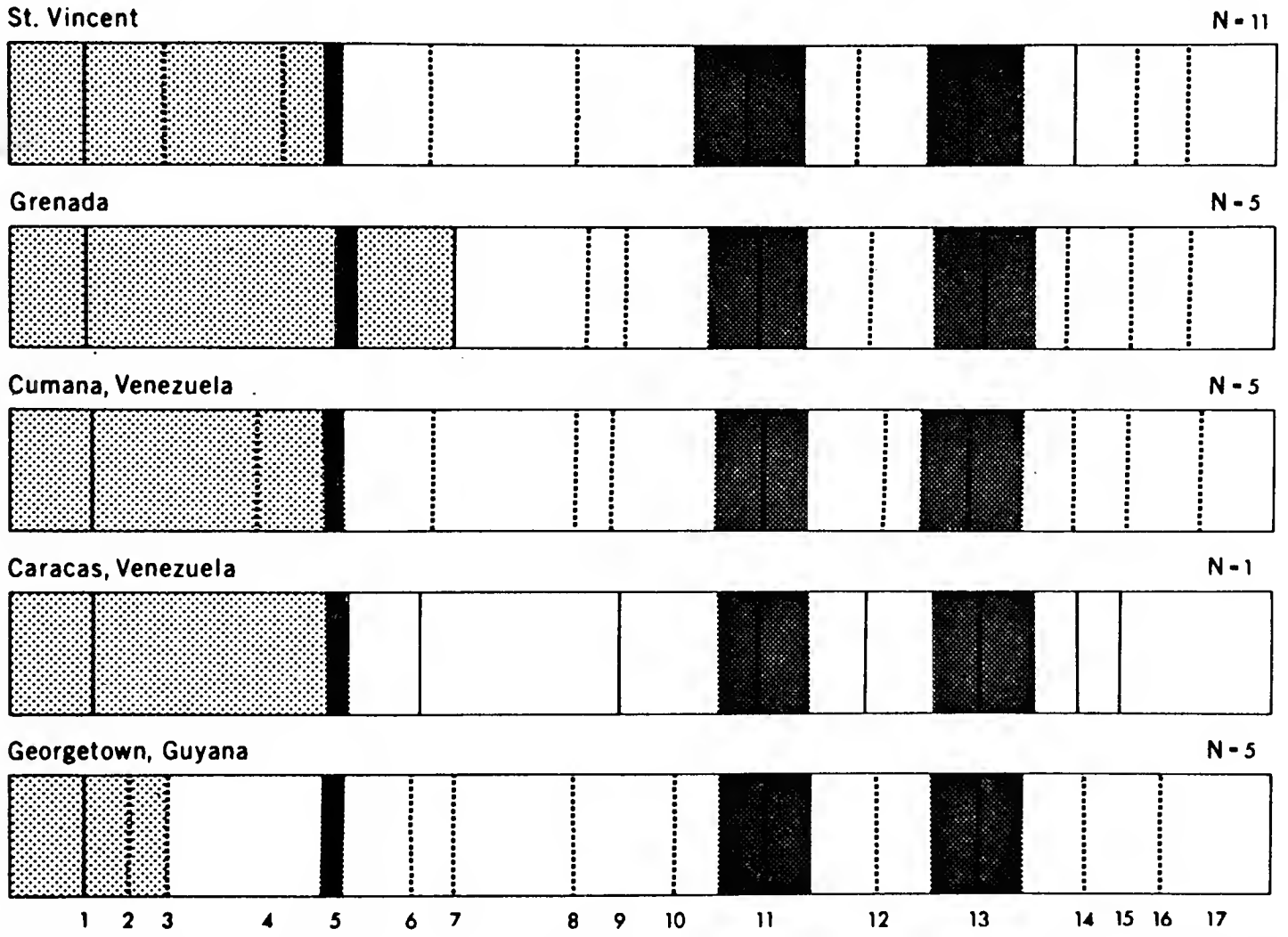

Figure 5. Electropherograms of *Eleutherodactylus johnstonei* leg muscle proteins from South American and West Indian populations as separated on 7% acrylamide gels. Vertical bars represent mean values for each protein observed. Solid vertical bars represent proteins found in all individuals within a sample; dotted vertical bars represent proteins of less frequent occurrence.

muscle proteins of the South American frogs (Fig. 5) clearly match *Eleutherodactylus johnstonei*, not *Eleutherodactylus martinicensis*. Seventeen protein fractions have been observed in the combined West Indian and South American samples, of which 4 (bands 1, 5, 11, and 13) are always present. Bands 12 and 14 are present in all populations, but not in all specimens of each population. With the exception of bands 2, 10, and 16, which occur only in the Georgetown population, the remaining bands are of infrequent occurrence, but occur at least once in both the South American and West Indian samples. Variations in these minor bands may be due to protein polymorphism.

Eleutherodactylus johnstonei has apparantly not spread throughout the city of Georgetown, Guyana, and is absent from the suburbs and open country immediately surrounding the city. A series of frogs recently identified as *johnstonei* (American Museum of Natural History) demonstrate, however, that the species has been in the city since at least 1923. Georgetown may have, in fact, been the point of earliest colonization of *E. johnstonei* on the South American mainland.

Over one hundred years ago Lichtenstein (1856) recorded "*Hylodes martinicensis*" (a name frequently applied to *johnstonei* prior to its description) from Caracas, Venezuela. It is doubtful, however, that his material represented either *johnstonei* or *martinicensis* or was even of West Indian origin. Juan Rivero (personal communication) first recorded *johnstonei* in Caracas in June, 1958, and assumed, on the basis of his field experience in Venezuela, that it had been recently introduced. Biologists in Caracas, informed us that the call of *johnstonei* was not commonly heard in the city until around 1960.

In a letter dated 10 March 1971, Juan Leon summarized the spread of *johnstonei* in Cumaná, Venezuela. An unspecified number of specimens was brought from Caracas in December, 1967, and released in the garden of the Chancellor's house at San Luis, Cumaná. As of March, 1971, this population had spread two miles east of the Chancellor's house and was estimated to include over 1,000 individuals. Small numbers of frogs are known to have been released in gardens 6 and 12 miles east of the Chancellor's house, but it is not known whether or not these introductions were successful. In early 1968 three males and four females were taken from the Chancellor's house to the campus of the University of Oriente, also in Cumaná. According to Mr. Leon, this population contained approximately 200 individuals in March, 1971.

Observations made at Willemstad in 1975 by Charles W. Myers suggest that *Eleutherodactylus johnstonei* was, at that time, a recent arrival in Curaçao. Males were heard calling in a garden near the western edge of Willemstad, but not in other nearby gardens or in the city itself.

Pough, Stewart, and Thomas (1977) noted that introduced species are "likely to make their first landfall in a coastal area" and that "the coastal margins of many Carribbean islands are hot and arid and successful colonizers must be able to tolerate these conditions". In their studies of Jamaican frogs they found that *E. johnstonei* and *E. planirostris* (both introduced in Jamaica) select higher temperatures, have higher CTM values, and are able to withstand greater water losses than two endemic Jamaican species, *E. cundalli* and *E. gossei*. They concluded that the

two introduced species are "evidently preadapted to being colonists because they can withstand hot, dry conditions". In St. Vincent we observed a single male *johnstonei* calling from a small boulder within 20 yards of the surf. Other males were calling from a nearby Coccoloba grove. Schwartz (1967) also recorded *johnstonei* from extremely xeric coastal areas (as well as from a wide variety of other habitats) and concluded that this species "is much less restricted in its habitat requirements than are most other West Indian *Eleutherodactylus*".

In addition to the physiological factors discussed by Pough, Stewart, and Thomas (1977), certain aspects of behavior may also function to make *johnstonei* a successful colonists.

Julian Kenny (personal communication) tells of a box of *johnstonei* which was inadvertantly spilled by a visiting biologist in the Maracas Valley, Trinidad. By evening of the same day, the males had established call sites and were actively calling. All of the males were subsequently recaptured and the introduction of *johnstonei* into Trinidad was prevented. This observation suggest that *johnstonei* adapts readily and immediately to new environments.

Wingate (1965) suggested communal breeding and egg laying in *johnstonei*. In captivity *johnstonei* call, mate, and produce viable eggs even when crowded. Clutches of fertilized eggs were occasionally found on moist paper towels in small plastic boxes containing eight to ten adult frogs. Egg deposition did not occur in ripe individuals of other eastern Carribbean species (including *martinicensis*) maintained under essentially identical conditions. Hughes (1962) found that *johnstonei* would breed in "boxes of dampened straw"; while Chibon (1960, 1962) obtained numerous clutches of eggs in a terrarium containing wet soil, gravel, and extremely dense vegetation (there is unequivocal evidence, based on Chibon's description of hatchlings, to show that his frogs were *E. johnstonei*; not *martinicensis* as he supposed). These observations, collectively suggest that *johnstonei* has an unusually low requirement for space and isolation during courtship activity.

In some, but not all species of *Eleutherdactylus*, the eggs are guarded by the male or female parent. Bayley (1950) states that, in *johnstonei*, the eggs are guarded by the female and that, when a clutch of eggs is discovered, there are usually four or five other frogs sheltered nearby. Although the other frogs escape immediately, the female must be prodded before leaving the eggs, and will sometimes urinate on them while escaping. Lemon (1971) and Adamson, Harrison, and Bayley (1960) agreed that it is the female that guards the eggs. The later authors noted that the female urinates on the eggs if disturbed while brooding. Chibon (1960) stated that the female is found very close to the eggs (but note apparantly not on or touching them). Wingate (1965) found one to five adults present with field collected eggs. Pope (1917), on the other hand, did not mention the presence of an adult frog with a clutch of field collected eggs in Bermuda; and Groome (personal communication) specifically observed unguarded clutches of eggs in Grenada. Eggs deposited in laboratory containers were either unguarded when discovered, or had one or more frogs sitting near, but not on them. Some of these eggs hatched successfully although they were heavily covered with fungus. These observations suggest that guardianship of the eggs in *E. johnstonei* is variable and ap-

parently not as highly developed as in some other members of the genus.

It is evident, then, that both physiological and behaviorial factors are probably involved in the remarkable ability of *Eleutherodactylus johnstonei* to colonize new areas. There is little information, however, on the effects of this colonization on either endemic or introduced species of *Eleutherodactylus* in areas which *johnstonei* has colonized.

On Jamaica, where multiple introductions have apparantly taken place (Perkins, 1942), *johnstonei* could conceivably co-exist, in time, with at least 15 other species of *Eleutherodactylus*. It is otherwise known to occur with *gossei* in Bermuda; with *martinicensis* in Antigua, Guadeloupe, and Martinique; with *pinchoni* in Guadeloupe; and with the frog currently referred to *urichi* in Grenada and St. Vincent.

Pough, Stewart, and Thomas (1977) studied the ecological relationships of *johnstonei* and *planirostris* (both introduced) with two endemic Jamaican species, *cundalli* and *gossei*. They recorded *johnstonei* primarily from disturbed habitats not suitable to the native species. Indeed competition with a variety of native species may account for the initial slow spread of *johnstonei* in Jamaica (about 6 miles in 40 or 50 years as reported by Perkins, 1942). On the other hand Pough, Stewart, and Thomas (1977) found that when coconut husk piles were denuded of frogs during the dry season, the husk piles were re-populated predominately by the introduced species (*johnstonei* and *planirostris*). The anuran fauna of these husk piles in subsequent seasons was unfortuneately not discussed.

Eleutherodactylus johnstonei arrived in Bermuda around 1880, while *Eleutherodactylus gossei* did not arrive until about 1906 (Dunn and Conant, 1937). The ranges of these two species were initially mutually exclusive, but they came together in about 1916 (Pope, 1917). *E. johnstonei* is now island-wide in distribution, while the range of *gossei* has apparently become static. Where the two species occur together, *gossei* is less abundant than *johnstonei* except in very moist situations (Wingate, 1965).

Hardy, Drewry, and Cole (unpublished MS), working in Guadeloupe, have found that *johnstonei* may displace *martinicensis* in agricultural environments. The peculiar limited distribution of *martinicensis* in Martinique (predominately in the forested uplands of the northern third of the island) may reflect similar displacement by *johnstonei*. Schwartz (1967) recorded no recently collected specimens of *martinicensis* from Antigua, an island on which few natural habitats remain. Here, too, *johnstonei* may be displacing (or may have displaced) *martinicensis* by selectively occupying disturbed (i.e. agricultural) habitats.

In St. Vincent the frog currently referred to *E. urichi* is far more abundant at the summit of Mt. Soufriere (where *johnstonei* does not occur) than it is on the lower slopes of the mountains where it occurs syntopically with *johnstonei*. These two areas are ecologically distinct however (ground bromeliads at the summit; heavy forests and agricultural areas on the lower slopes), and this, rather than competition with *johnstonei*, may account for the differences in relative abundance. In Grenada, on the other hand, "*urichi*" occurred in St. George's in 1910. At that time *johnstonei* had probably been on Grenada for no more than 25 years (Bar-

bour, 1914; Groome, 1970) and was probably restricted to low, coastal areas. It had, however, reached the interior highlands (Grand Etang) by at least 1937 (Cochran, 1938). *Eleutherodactylus "urichi"* no longer occurs in St. George's (or the lowlands around St. George's), while *johnstonei* is quite abundant both in and around the city. Both species now occur in the forests surrounding Grand Etang; but, in this area, *johnstonei* is conspicuously more abundant than *"urichi"*.

These observations strongly suggest that *johnstonei* may, indeed, displace both native and introduced populations of *Eleutherodactylus* in areas which it has colonized. This seems to be particularily (but probably not exclusively) true of disturbed habitats. The spread of *Eleutherodactylus johnstonei* on the South American mainland may, therefore, in time drastically effect members of the local *Eleutherodactylus* fauna.

SPECIMENS EXAMINED

Eastern Caribbean

Grenada. USNM 194388-96, Grand Etang, 26 June 1970; USNM 194397-8, Grand Etang, 9 July 1971.

St. Vincent. USNM 194399-400, Lowrt, 24 June 1970; USNM 194401-14, Lowrt, 5 July 1971; USNM 194415, Soufriere, River Soufriere, 1000 feet, 7 July 1971.

Netherlands Antilles

Curaçao. AMNH 90933-4, near western edge of Willemstad, 29 August 1975.

South America

Guyana. USNM 194416-28, Georgetown, Belair Park, 6 July 1970.

Venezuela. USNM 194429-41, Caracas, "late 1960's"; USNM 194442-6, Cumaná, San Luis, 6 July 1970.

Acknowledgements

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SURFACE ACTIVITY AND HORIZONTAL MOVEMENTS IN A MARKED POPULATION OF *SISTRURUS MILIARIUS BARBOURI*

James A. Hudnall

Field observations on activity and field movements of the Dusky Pigmy Rattlesnake (*Sistrurus miliarius barbouri* Gloyd) were made in Florida in a cypress-sawgrass-palmetto habitat 5 miles west of Palm Beach Gardens, Palm Beach County (Fig. 1). Reported here are observations on 64 individuals, 50 of which were marked in a local population (16 recaptured 1-5 times) between March 26, 1975 and November 14, 1976. These snakes are evening-crepuscular and nocturnal from Spring to Fall, shifting to afternoon-diurnal during Winter. Evidence was found suggesting the occurrence of home ranges in this species.

Fig. 1. Study area in December 1977. Major plant species include saw grass (*Cladium jamaicensis*), pond cypress (*Taxodium distichum*), and saw palmetto (*Serenoa repens*).

The study area (Fig. 1) borders a canal, no. C-18, maintained by the Central and Southern Florida Flood Control District. The soil from the digging of the canal was piled up ca. 7 m away and paralled to the banks to form sand-shell rock levees ca. 23 m wide and 2.5 m high. These levees were weedy and periodically mown, leaving dense vegetation only on the steep canal bank and 1.5 m from the lip intact. Transects to capture snakes were walked along the mown vegetation interface or edge; recapture data provided one-dimensional field movements. On capture individuals were tagged, weighed, measured, sexed (sexed based on external tail morphology) and released.

The tagging method used employs colored beads on monofilament suture-line that is sewn into the snake's tail, and the length measurements were made using both photographic and chill-coma methods. These methods are described in detail elsewhere (Hudnall, in press).

Time and Season of Surface Activity. -- Transects (29 times) were completed by 1200 hrs (86.2%); a few afternoon (1500-1900 hrs) observations are included. Most individuals (63 = 84% of 75 observations) were found coiled in a resting position. Of the 12 observations of actively moving individuals at the time of capture, 5 were seen in the afternoon. Only 1 observation of a coiled snake was made in the afternoon. It was found that 25 (39.7%) of 63 coiled snakes were positioned such that morning sunlight would strike them within the first two hours after dawn; the others were primarily located to the west of vegetative cover or in erosion cuts in the bank such that they would remain shaded for most of the morning.

A linear regression of overnight low temperatures against number of Dusky Pigmy Rattlesnakes seen during an observation session produced a non-significant line ($r = 0.127$, $df = 27$).

Numbers of observations of *Sistrurus miliarius barbouri* were distributed as follows based on successful field sessions: April, 5 observed in 3 sessions; May, 12 observed in 6 sessions; June, 4 observed in 3 sessions; September, 17 observed in 6 sessions; October, 18 observed in 4 sessions; November, 14 observed in 5 sessions; December, 5 observed in 2 sessions. These data coincide predictably with data of Chamberlain (1935) for *Sistrurus miliarius* in South Carolina and data of Palmer and Williamson (1971) in North Carolina. Of Chamberlain's observations, 65% were made from July to September while Palmer and Williamson recorded 66% of their sitings during these months. Most of mine were observed from September to November, explainable with colder and harsher weather arriving earlier in the northern states. It was concluded by Chamberlain (1935), and I concur, that "it appears that some individuals may be active at almost any time during the year except in the coldest weather." In coastal south Florida "coldest weather" is usually no more than 5 consecutive days in duration. No evidence of denning behavior was found; only single individuals were observed with the exception of one occasion (September) when two snakes (male and female) were located within 4 m of each other.

Thus, the over-all picture for *Sistrurus miliarius barbouri* in my study area is a year-around active snake lacking a hibernation period. They seem to be afternoon-crepuscular and early evening nocturnal from March-October (assume July-August with no personal observations), being found coiled and asleep in the mornings and moving to cover for the day by noon. From November-February they seem to be primarily afternoon-diurnal, most of which time is spent basking or moving to and from a basking site.

During all seasons, it was found that very few individuals (ca. 5 out of ca. 55 observations) were inclined to strike when harassed with a moving boot. The usual reaction was to coil to strike, rattle, then retreat.

Only three snakes assumed to be young-of-the-year were captured during this study: 11 October 1975, SVL = 220 mm; 18 October 1975, SVL = 229 mm; 23 November 1975, SVL = 227 mm. Each had a button at the time of capture, and the 229 mm snake possessed one additional segment. Snout-vent lengths of August *S. m. streckeri* reported by Fleet and Kroll (1978) in east Texas did not exceed 161 mm; unless newborn *S. m. barbouri* exceed this, the juveniles reported here would be 1-3 months old.

TABLE 1

ID#	Snout-vent Length at First Capture (mm)	No. Times Recaptured	$\bar{x} \pm$ St. Error Distance Travelled (m)	Total Movement Since First Capture (m)	Max. Distance From First Capture Point (km)	Days From First to Last Capture
20	459	5	179.6 ± 81.5	898.0	0.2393	84
19	375	3	81.0 ± 67.1	243.0	0.2258	62
36	416	3	89.5 ± 34.6	268.5	0.1128	294
21	469	2	121.2 ± 114.5	242.3	0.2423	42
28	479	2	151.7 ± 80.3	303.3	0.2320	355
4	526	1	93.6	93.6	0.0936	13
5	445	1	9.1	9.1	0.0091	14
7	420	1	30.2	30.2	0.0302	16
8	476	1	66.8	66.8	0.0668	14
18	422	1	69.5	69.5	0.0695	8
22	296	1	118.9	118.9	0.1189	35
25	362	1	9.1	9.1	0.0091	7
30	331	1	132.3	132.3	0.1323	21
33	461	1	16.8	16.8	0.0168	7
40	384	1	37.8	37.8	0.0378	162
42	411	1	89.0	89.0	0.0890	57

Table 1. Field movements of marked and recaptured *Sistrurus miliarius barbouri* in southern Florida.

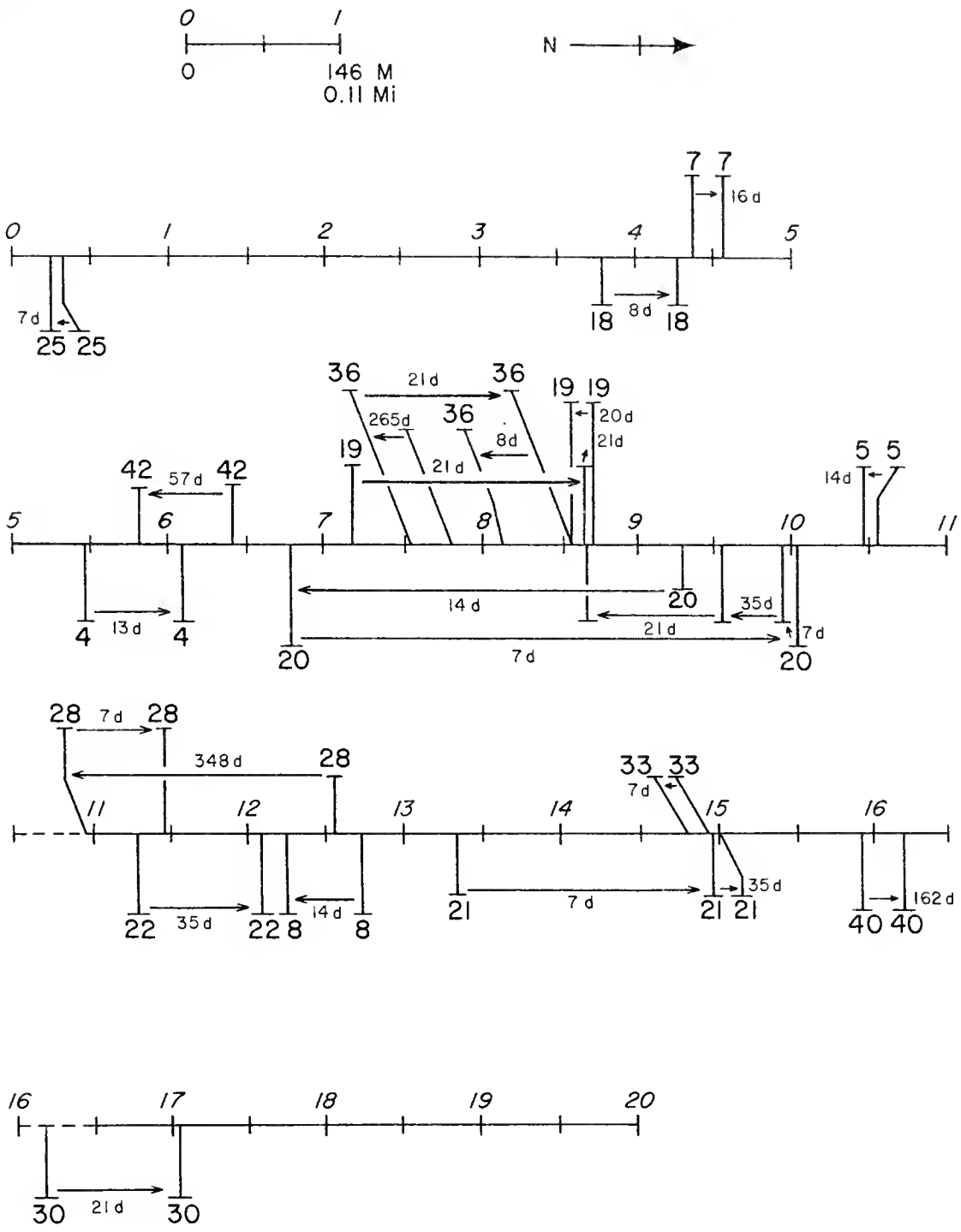

Fig. 2. Diagrammatic map of recaptures of marked Dusky Pigmy Rattlesnakes; the 2920 m transect line is indicated here in four divided parts. Time elapsed in days (d) is shown between each capture point.

No gravid individuals were noted at any time during the study.

Field Movements of Marked Individuals. -- Reduced data for movements of recaptured individuals is given in Table 1. Average distance traveled per capture and total movement, while variable, both indicate that individual *Sistrurus miliarius barbouri* actively move within this restricted habitat. The measurement of maximum distance from the initial capture point reveals that the snakes are generally not moving unidirectionally, and may be moving within a definable stable home range. The capture points plotted for snake number 20 (male, see Fig. 2) is a strong case supporting the existence of home ranges in the Florida study area; several of the other individuals also indicate definite home range behavior.

Of fifty snakes marked over 1.5 years, 8 of the 16 total recaptured individuals (50%) were recaptured within 1-3 weeks and never seen again. Fitch (1949), in discussing low recapture percentages and large movements recorded for some *Crotalus viridis oreganus* in California, concluded that some individuals in his population were wandering randomly while some

long trips seemed to be shifts to new, restricted home ranges. The sedentariness through time of several of his crotalid snakes, as with mine, strongly suggest limited home ranges in rattlesnakes. Fleet and Kroll (1978) reported a gravid female *S. m. streckeri* in east Texas that was observed 7 times from 1 July 1976 to 3 August 1976; it remained within 2 m of its original capture point.

The data reported here for a marked population support an earlier impression of highly localized behavior of unmarked individuals in similar Florida habitats as observed over the past twelve years of field observations on the species. The conclusion on home range behavior in *Sistrurus miliarius barbouri* is also in agreement with the criterion of the long-term movement of individual snakes not being exceeded greatly by short-term movements of other individuals (Stickel and Cope, 1947).

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A Study of the Homing Instinct in *Terrapene c. carolina* in Maryland

During the six week period from 9 June 1978 to 22 July 1978, the movements of 13 displaced eastern box turtles, *Terrapene c. carolina* (Linnaeus), were studied. This project was conducted in conjunction with ongoing studies of the eastern box turtle at the Douglas Point Field Station for Terrestrial Studies, a 1400 acre tract of land on the eastern shore of the Potomac River in Charles County, Md., approximately 48 kilometers south of the District of Columbia.

Upon capture, each turtle was fitted with a thread trailing device which was a modification of that used by Stickel (1950). Previous experimenters have shown that this type of trailing device does not significantly alter the turtle's pattern of movement (Stickel, 1950). Where possible, turtles were trailed for several days within their home range to obtain an idea of their normal movement patterns and to get an approximation of the extent of their home range. After the home range information had been obtained, the turtles were relocated. Ten of the turtles were relocated from 500 meters to 900 meters from their home range. The remaining three turtles were displaced 1.6 km, 4 km, and 8 km from their capture point.

Of the 10 turtles displaced less than 900 meters, nine returned to their home range. The pattern of movement observed during their return was markedly different from that observed within their home range. The movements observed for those turtles within their home range consisted of repeated doubling, turning, and little unidirectional movement. This type of home range movement pattern is consistant with that observed by other authors (Dolbeer, 1969; Gould, 1957; Nichols, 1939; Stickel, 1950). However, the pattern of movement observed in those turtles returning to their home range consisted of an initial period of erratic movement (usually less than 10 meters) followed by a period of unidirectional movement which continued until the individual had returned to the vicinity of its home range. For five individuals, this unidirectional movement was actually in the form of a slight arc rather than a straight path towards its home range. In all but one case, however, this arcing pattern of movement could be accounted for because the box turtle was following either a road or a stream valley. As noted in a previous study (Lemkau, 1970), the returning turtles tend to follow natural or manmade boundaries such as streams, roads, and washouts.

As mentioned above, one of the ten turtles did not attempt to return to its home range. This particular individual had been displaced approximetely 600 meters. This individual, however, did not exhibit a typical home range pattern of movement upon relocation. Rather, the pattern of movement was very erratic, characterized by numerous circling movements and more turns than were observed in the home range movements observed for this individual.

Of the three turtles relocated more than 1.6 km, none attempted to return to its point of capture. Within several days of release, all three individuals began to exhibit a pattern of movement similar to that seen for the home range. This type of behavior was also seen in a 1974 study in which seven three-toed box turtles (*Terrapene c. triunquis*) were removed 1.6 km to 3.2 km from their capture point and established new home ranges rather than returning to their original ones (Schwartz & Schwartz, 1974).

On the basis of this study it appears that at least some eastern box turtles exhibit a homing instinct. However, the distance from which a box turtle will return to its home range does seem to be limited. For some individuals, this critical distance appears to be less than 1.6 km.

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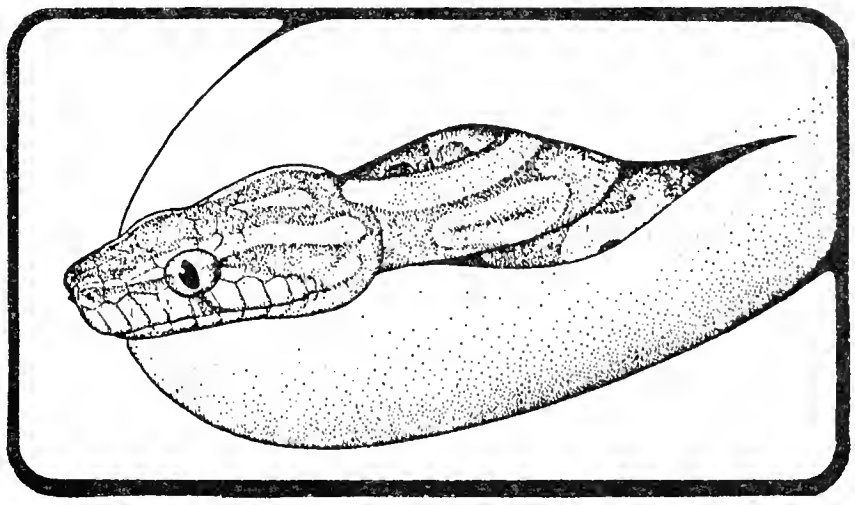

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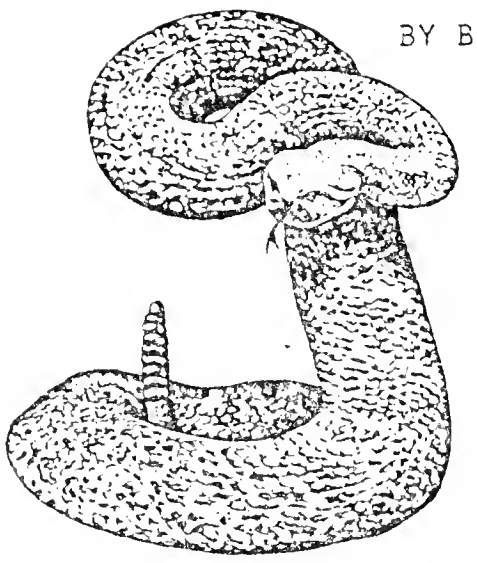

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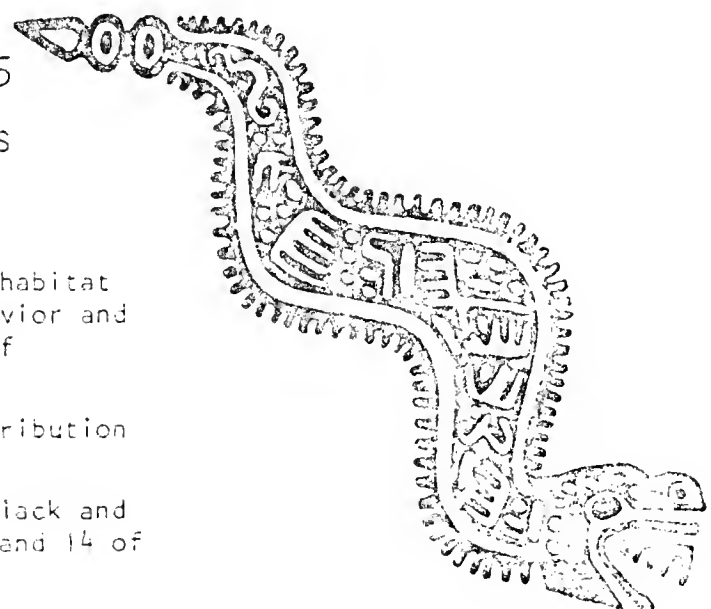

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